TM 9-2355-106-10

OPERATOR MANUAL
COMMERCIAL OFF-THE-SHELF (COTS)
for
INTERNATIONAL
MINE RESISTANT VEHICLE

CATEGORY I
2355-01-553-4634
CATEGORY II
2355-01-553-4636

Manufactured by
International Military and Government, L.L.C.

11 September 2007

Warning Summary

WARNINGS, CAUTIONS, and NOTES

Read and observe all WARNING, CAUTION, and NOTE alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both**.**

This section clarifies the use of **WARNINGS, CAUTIONS,** and **NOTES** as follows**:**

WARNINGS are presented in **BOLD** type and may result in serious injury or death to personnel.

CAUTIONS are presented in **BOLD** type, following **WARNINGS,** and may result in damage to equipment.

NOTE

NOTES are presented in NORMAL type, following **WARNINGS** and **CAUTIONS,** and are general statements**.**

WARNING SUMMARY

WARNING

- Carbon monoxide is a colorless, odorless, poisonous gas that when breathed deprives the body of oxygen and causes suffocation. The following precautions must be followed to avoid carbon monoxide poisoning. Failure to comply may result in permanent brain damage or death.
- Do not operate personnel heater or vehicle engine in an enclosed area without adequate ventilation.
- The Auxiliary Diesel Heater must be switched off while any fuel tank on the vehicle is being filled.
- Do not idle the vehicle for long periods of time.
- Do not sleep in the vehicle with the heater operating or engine idling.
- Notify Field Maintenance if exhaust fumes are detected in the crew compartment while operating the vehicle.
- Be alert at all times for exhaust odors and symptoms of exposure to carbon monoxide such as headaches, dizziness, loss of muscular control, apparent drowsiness, and coma. If symptoms are evident, move the affected personnel to fresh air, keep them warm, do not permit physical exercise, administer artificial respiration (if necessary), and seek immediate medical attention.

- Vehicles are finished with a chemical agent resistant coating (CARC). CARC contains isocyanates which are highly irritating to skin and the respiratory system. Breathing of vapor or dried paint dust can cause cough, shortness of breath, a burning sensation in throat and nose, watering of the eyes, pain during respiration, and chest tightness. Skin contact with particulates can cause itching or redness of the skin.
- Only qualified painters working in fully equipped facilities in protective gear and respirators should perform CARC painting operations.
- Never weld or cut CARC coated surfaces.
- Grinding or sanding on CARC coated surfaces will create harmful dust. All individuals in the area must wear high-efficiency air purifying respirators, protective goggles, gloves, and other protective clothing. Thoroughly wash all clothing before reuse.
- No persons who have lung or breathing problems or who have had a reaction to isocyanates should be in the area where they are used or where CARC dust particles are present. Individuals who are sensitive to isocyanates may experience increasing sensitivity on repeated exposure.

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- When using compressed air for cleaning purposes, do not exceed 30 psi (207 kPa). Wear gloves and eye protection. Do not aim compressed air at yourself or other people. Failure to comply may cause injury to personnel.
- Remove all jewelry before conducting maintenance. Do not wear watches, rings, dog tags, or other jewelry which could short across battery terminals or catch on vehicle components. Failure to comply may result in injury to personnel.
- Always maintain three points of contact when climbing on the vehicle. Never jump from the vehicle. Use ladders during maintenance as applicable. Failure to comply may result in injury to personnel.
- Ensure cargo is stowed and secured in accordance with load plan. Do not block fire sensors or extinguisher nozzles. Do not block egress paths. Failure to comply may result in injury to personnel and damage to equipment.
- Do not exceed the rated payload of the vehicle. Failure to comply may result in injury to personnel and damage to equipment.
- In extreme temperature environments, follow work-rest schedules as well as the guidance of TB-MED 507 *Heat Stress Control and Heat Stress Management* and TB-MED 508 *Prevention and Management of Cold Weather Injuries.* Failure to comply may result in injury to personnel.
- Antenna emit radiofrequency radiation. Do not touch active antenna and maintain proper standoff distances from active antenna as specified in radio equipment TM. Ensure radios are powered off before conducting fueling operations or maintenance activities. Failure to comply may result in injury to personnel.
- Rotating parts can cause severe injury to personnel. Ensure all guards are in place. Do not wear loose clothing when conducting maintenance. Always check to ensure area is clear of personnel and obstructions before starting engine. Failure to comply may result in injury to personnel.
- Single hearing protection is required in and around an operating vehicle. Double hearing protection is required during weapons firing. Failure to comply may result in injury to personnel.
- Ensure tire pressures are maintained at the proper levels. Low air pressures can result in tire failure. Use tire cages during tire inflation. Failure to comply may result in injury to personnel and damage to equipment.

WARNING SUMMARY

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- Wheel and tire assembly is heavy. DO NOT attempt to lift or catch wheel and tire assembly without the aid of an assistant and a suitable lifting device. Failure to comply may result in serious injury or death to personnel.
- Vehicle must be parked on hard, level surface where jacks will be level. Attempting to change wheel/tire assembly on non-level or soft surface may result in jack/jack stand and/or vehicle falling. Failure to comply will result in equipment damage and or serious injury or death to personnel.
- Doors are heavy. Use caution when opening or closing doors especially when the vehicle is parked on an incline. Failure to do so may result in injury to personnel.

- The gunner's sliding hatch can only be opened or closed when the vehicle is stationary and on a level surface. DO NOT attempt to open or close the hatch when the vehicle is in motion. Keep arms and hands clear of gunners hatch when closing it. Failure to comply may result in serious injury or death to personnel.
- Ensure that the gunners hatch is in the locked position before moving the vehicle. Use extreme caution when standing in gunner's hatch while vehicle is in motion; gunner should be holding onto the weapon or other suitable handle to maintain a stable posture at all times. Failure to comply may result in serious injury or death to personnel.
- Vehicle must not be operated with the Emergency roof hatch open. Keep arms, hands and head clear of Emergency roof hatch when closing it. Failure to comply may result in serious injury or death to personnel.
- Roof hatches are heavy. Use caution when opening or closing the roof hatches. Ensure roof hatches are locked when in the open position. Failure to do so may result in injury to personnel.
- When opening or closing the gunners hatch side lock latch, the vehicle must be stopped and on a flat level surface. The latch is spring-loaded and if there is any added tension on it, gunner will not be able to release lever. Failure to comply may result in serious injury or death to personnel.
- Ensure (by looking out one of the small rear windows) that no one is behind the vehicle when lowering the rear door/ramp. DO NOT operate the rear door/ramp when vehicle is in motion. Use extreme caution when using the emergency rear door/ramp release that no one can be struck by the door as it falls open. Sound horn before lowering door/ramp. Keep arms and legs clear of rear door/ramp when closing it. Failure to comply may result in serious injury or death to personnel.
- Before opening the hood, ensure that there is enough room in front of the vehicle for the hood to open completely without pinning or pinching yourself or an assistant between the hood and any other structure. Failure to comply may result in serious injury or death.
- DO NOT use steering wheel for hand grip to enter or exit vehicle cab. Use of steering wheel for hand grip may cause sudden violent jerking of vehicle. When entering or exiting cab, use three-point contact system. Failure to comply may result in injury or death to personnel.
- Hydraulic jacks are intended only for lifting the vehicle and not for supporting the vehicle while performing maintenance. DO NOT get under vehicle after vehicle is raised, unless it is properly supported with blocks or jack stands. Failure to comply may result in injury or death to personnel.

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- Engine components become extremely hot during normal operation. Allow engine to cool completely prior to performing any task. DO NOT touch the exhaust system components with bare hands or with your body. Use protective work gloves and long sleeves. Failure to comply may result in damage to equipment and or serious burns, injury, or death to personnel.
- The engine cooling system is hot and pressurized. Do not remove the radiator cap while the engine is hot; steam and hot coolant can escape and burn personnel. Allow the system to cool and remove the cap slowly to relieve pressure. Failure to comply may result in serious injury or death to personnel.
- Coolant is poisonous if ingested. Avoid skin and eye contact. If skin contact occurs wash the affected area immediately with soap and water. If eye contact occurs flush with water and seek medical attention. Failure to comply may result in injury to personnel.
- DO NOT touch extremely cold metal (below -26°F [-32°C]). Bare skin may freeze on cold metal. Failure to comply may result in serious injury to personnel.
- Cooling system components are very hot and pressurized during vehicle operation. Allow cooling system to cool before checking hoses. Failure to comply may result in injury to personnel.

- The driver is responsible for the safety of personnel riding in their vehicle. Drivers will refuse to move a vehicle if anyone is in an unsafe position or the vehicle has too many passengers. Passenger load for Category I vehicles is 6 persons, and Category II is 10 persons. Ensure all personnel are clear of vehicle before engine start is attempted. Operator/driver must visually check to make sure all areas of vehicle are clear of personnel prior to attempting to start engine. Always use seat belts/shoulder harnesses when vehicle is in operation. Ensure driver side and passenger side mirrors are adjusted to allow for full range of vision prior to operating vehicle. Failure to comply may result in serious injury or death to personnel.
- The driver's field of view is limited. Ground guides must be used when operating in congested areas or when operating in reverse. Ground gujdes must stand clear of the vehicle and remain within view of the driver. Failure to comply may result in injury or death to personnel and damage to equipment.
- If the operator/driver leaves the vehicle, even momentarily, when engine is running, the transmission MUST be placed in NEUTRAL (N), PARKING BRAKE set, and wheels chocked. Unexpected or sudden vehicle movement may occur which may result in damage to equipment and or serious injury or death to personnel.
- The vehicle has a high center of gravity. Slow down for turns and other maneuvers. Approach slopes head on and avoid side slopes when possible. Failure to comply may result in injury or death to personnel and damage to equipment.
- Do not attempt to ford water deeper than 36 inches. Ensure bottom surface under water is hard. Reduce speed during fording. Ensure brakes are dry and operating correctly upon completion of fording operation before commencing normal driving. Failure to comply may result in injury to personnel or damage to equipment.

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- Care must be taken when handling or working near batteries. Hydrogen gas emitted from the batteries is flammable and hazardous to health. Do not smoke, have open flames, or make sparks around a battery. Battery acid (electrolyte) is extremely harmful. Wear acid-proof gloves, eye protection, and rubber apron to prevent contact. In the event of skin or eye contact, flush with cold water and seek medical attention. Avoid inhaling battery vapors and immediately discard all rags after wiping the batteries and battery box. Failure to comply may result in severe burns, respiratory problems, and damage to equipment.
- Ensure batteries are disconnected when performing maintenance on or near batteries or electrical systems. Ensure stored voltage is discharged from equipment before conducting maintenance. Always remove negative battery terminals first. When reconnecting, always connect positive terminals last to avoid arcing or sparks that could cause an explosion. DO NOT allow tools to contact battery box or other battery terminals when removing or installing terminals. Failure to comply may result in damage to equipment and or serious injury or death to personnel.
- Battery Connector GAA is harmful to skin. Prolonged or repeated contact with skin or contact with eyes may cause irritation. If eyes are contacted, rinse thoroughly and contact physician if irritation persists. If skin is contacted, wash thoroughly with soap and water. Failure to comply may result in serious injury or death to personnel.
- Wear safety goggles, acid proof gloves, and a rubber apron in a well ventilated area when performing battery maintenance. Failure to comply may result in injury or death to personnel.

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- Prior to towing disabled vehicle, ensure brake lights, emergency flashers, turn signals, and air systems are operating on disabled vehicle in conjunction with those on towing vehicle. Failure to comply may result in damage to equipment and or serious injury or death to personnel.
- DO NOT position hands near pintle hook while aligning or removing tow bar with pintle hook on towing vehicle. Failure to comply may result in serious injury to personnel.
- At night, the center of the tow bar must be clearly marked to ensure that it is visible to other road users. The maximum speed limit when towing is 25 mph (40 km/h). Avoid sharp turns. Failure to comply may result in injury to personnel and damage to equipment.
- The ABS function on a disabled vehicle is NOT operational when vehicle is being towed. DO NOT rely on the ABS function of the disabled vehicle when being towed. Failure to comply may result in damage to equipment and or serious injury or death to personnel.
- The vehicle must not be driven with the brakes caged. Failure to comply may result in damage to equipment and or serious injury or death to personnel.
- When operating the vehicle in the transmission limp home mode, the operator must stay in vehicle and use only the service brakes to hold the vehicle into place. Failure to comply may result in injury or death to personnel.
- When towing, ensure that all personnel are clear of vehicle before removing wheel chocks and starting vehicle towing. Personnel must not occupy vehicle being towed. Use reasonable speeds for road conditions and caution when making turns. Prior to disconnecting tow bar, ensure that vehicles are on level surface and wheels are chocked. Failure to comply may result in damage to equipment, injury, or death to personnel.
- If brakes of disabled vehicle are inoperable, DO NOT flat tow disabled vehicle. Call for wrecker support. Failure to comply may result in injury or death to personnel.

- Fuel is flammable and can explode. Keep fuel away from open flame and keep fire extinguisher within easy reach when working with fuel. DO NOT work on fuel system when engine is hot. Fuel can be ignited by hot engine. Smoking is prohibited while working with fuel. Never use gasoline to clean parts. Failure to comply may result in serious injury or death to personnel.
- Do not fill fuel tank with engine running. Do not over fill fuel tank. Clean fuel spills immediately. Ensure fuel nozzle is grounded to filler neck to prevent sparks. Failure to comply may result in injury or death to personnel and damage to equipment.
- Be alert at all times for the smell of fuel. Hot engines and components can ignite fuel. If fuel smell is detected while operating vehicle, shut down vehicle immediately and notify Field Maintenance. Failure to comply may result in damage to equipment, injury, or death to personnel.

WARNING SUMMARY

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- Adhesives, solvents, sealants, lubricants, and fuel are flammable and hazardous to health. Use in a well-ventilated area and away from sources of heat. Keep a fire extinguisher within reach. Wear gloves, face shield, and protective clothing. If contact with skin occurs, wash the affected area immediately with soap and water. If eye contact occurs, flush with water and seek medical attention. Failure to comply may cause injury to personnel.
- Clean up all fluid spills. Spills can create slip and fire hazards. Dispose of materials in accordance with local hazardous waste disposal procedures. Failure to comply may result in injury to personnel and damage to the environment.
- Anti-corrosion compound is toxic. Use only in well-ventilated area. Use approved respirator with dual organic vapor/mist and particulate cartridge. Wear chemical safety goggles and full face shield when using. Avoid contact with skin and wear rubber or plastic, solvent-resistant gloves. In case of contact, remove contaminated clothing and immediately wash area with soap and water. If eyes are contacted, flush eyes with large amounts of water for at least 15 minutes and get immediate medical attention. If swallowed, DO NOT INDUCE VOMITING; contact a physician immediately. Failure to comply may result in serious injury or death to personnel.
- Electrical connector lubricant is harmful to skin. Prolonged or repeated contact with skin or contact with eyes may cause irritation. If eyes are contacted, rinse thoroughly and contact physician if irritation persists. If skin is contacted, wash thoroughly with soap and water. Failure to comply may result in serious injury or death to personnel**.**

- DO NOT disconnect any air line or fitting until system pressure has been relieved. Air under pressure can penetrate the skin. Failure to comply may result in serious injury or death to personnel.
- DO NOT have or apply open flames to air lines or valves. This can cause internal damage to non-metallic parts of valves and melt or burn non metallic air lines. This can also result in vehicle fire. Do not pour liquids or methanol into air lines or hose couplings; this can cause immediate and severe damage to rubber components. Fluids poured into the system will wash lubricants out of valves and collect in brake chambers and valves. Failure to comply will result in damage to equipment and or serious injury or death to personnel.
- Protective eye goggles or face shields need to be worn. Air drain valves are under pressure. DO NOT place face in front of air drain valves while draining air reservoirs. Open air drain valves slowly to prevent sudden blast of air. Failure to comply may result in serious injury or death to personnel.
- Before performing PMCS, be sure that parking brake is applied, transmission is in NEUTRAL (N) and wheels are chocked. Failure to comply may result in damage to equipment and or serious injury or death to personnel.
- Wear eye protection and gloves when working on or around hydraulic systems. Hydraulic hoses, fittings, and components can contain high pressure. Failure to comply may result in injury or death to personnel.

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- Discharging large quantities of dry chemical fire extinguisher in cab may result in temporary breathing difficulty during and immediately after the discharge event. If at all possible, discharge fire extinguisher from outside the cab. Ventilate and wash cab thoroughly prior to reentry. If respiratory irritation or distress occurs, remove victim to fresh air. Seek medical attention if irritation persists.

  Eyes: Flush with cold water for no less than 15 minutes and seek medical attention immediately.

  Skin: Flush with large amounts of cold water until all acid is removed. Seek medical attention as required.

  Internal: If victim is conscious and alert, give two to three glasses of water to drink and DO NOT induce vomiting. DO NOT leave victim unattended. To prevent aspiration of swallowed product, lay victim on side with head lower than waist. If vomiting occurs and the victim is conscious, give water to further dilute the chemical. Seek medical attention immediately.

- Adhesives, solvents, and sealing compounds burn easily, can give off harmful vapors, and are harmful to skin and clothing. Keep away from open fire and use in a well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap and water. Failure to comply may result in injury or death to personnel.
- Use care when working around or with ether canister as they are pressurized and flammable. Read label before installing. Keep away from flames, DO NOT incinerate or puncture canister. Keep away from temperatures above 120°F (49°C). DO NOT store spare in cab. It contains hazardous materials and must be handled with care and disposed of in accordance with current directives. Do not allow ether liquid or vapor to contact skin or eyes and avoid breathing fumes. If swallowed, DO NOT INDUCE VOMITING. Immediately seek medical attention. Failure to comply may result in serious injury or death to personnel.

WARNING SUMMARY

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- The service brakes should always be used as the primary vehicle braking system. The exhaust brake should never be considered a substitute for the vehicle's service brakes. The exhaust brake cannot bring the vehicle to a complete stop. Only the service brakes can bring the vehicle to a complete stop. Using the exhaust brakes in place of the service brakes may result in damage to equipment and or serious injury or death to personnel.
- Rapid operation of service brakes will consume compressed air supply and may cause automatic spring brake application. Always observe air pressure gauges. Failure to comply may result in damage to equipment and or serious injury or death to personnel.
- DO NOT operate vehicle with air pressure system loss, this is extremely dangerous. Vehicle has reduced or no braking capability and may not stop. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

- Increased effort may be required to turn steering wheel if there is a failure of power steering system or engine stops running. Stop vehicle as soon as road conditions permit. Operating vehicle with impaired steering can result in damage to equipment and or serious injury or death to personnel.
- DO NOT allow vehicle to coast in NEUTRAL (N), because engine and transmission assist in slowing the vehicle. This is unsafe operation. Failure to comply may result in severe equipment damage and or serious injury or death to personnel.

- Nuclear, Biological, or Chemical (NBC) contaminated air filters must be handled and disposed of only by authorized and trained personnel. The unit commander or senior officer in charge of maintenance personnel must ensure that prescribed protective clothing is used, and prescribed safety measures and decontamination procedures are followed. The unit standard operating procedures are responsible for final disposal of contaminated air filters. Failure to comply may result in serious injury or death to personnel.

WARNING SUMMARY

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- To avoid injury to hands or fingers, always keep hands clear of wire rope, hook loop, hook and fairlead opening during installation, operation, and when spooling in or out. Always wear heavy leather gloves when handling a wire rope. Always remove all jewelry to avoid being caught in wire rope and wear eye protection. Never let a wire rope slip through your hands. Always be aware of possible hot surface at winch motor, drum, or wire rope during or after winch use. Always use extreme caution when handling hook and wire rope during spooling operations. Always use supplied hook strap whenever spooling wire rope in or out, during installation or operation to avoid injury to hands or fingers.
- Never use as a hoist, or to suspend a load. Never use to lift or move persons. Failure to observe these instructions could lead to serve injury or death to personnel.
- Failure to observe these instructions could result in injury to personnel. Always inspect winch installation and wire rope before operating winch. Frayed, kinked, or damaged wire rope must be replaced immediately. Loose or damaged winch installation must be corrected immediately.
- Never winch with less than five wraps of wire around the drum, the wire rope could come loose from the drum. Never touch wire rope or hook while in tension or under load. Never touch wire rope or hook while someone else is at the control switch or during winching operation. Never touch wire rope or hook while remote control is plugged into winch. Never exceed winch or wire rope rated capacity. Never engage or disengage clutch if winch is under load, wire rope is in tension, or wire rope drum is moving.
- Always stand clear of wire rope and load and keep others away while winching. Always require operator and by standers to be aware of stability during winching of vehicle and/or load. Always keep remote control lead clear of the drum, wire rope, and rigging. Inspect for cracks, pinches, frayed wires, or loose connections. Replace if damaged.
- If recovery strap is used for anything other than to snatch or pull out a stuck vehicle, the strap can break, causing serious equipment damage or serious injury or death to personnel.

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TM 9-2355-106-10
HEADQUARTERS, DEPARTMENT OF THE ARMY
WASHINGTON D.C., 11 SEPTEMBER 2007

OPERATOR MANUAL

COMMERCIAL OFF-THE-SHELF (COTS)

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INTERNATIONAL

MINE RESISTANT VEHICLE

CATEGORY I

2355-01-553-4634

CATEGORY II

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International Military and Government, L.L.C.

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS
You can help improve this manual. If you find any mistakes, or if you know of a way to improve procedures, please let us know. Mail comments directly to: PM-MRAP, AMSTA-LC-GMM, 6501 E. 11 Mile Road, Warren, MI 48397-5000.

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HOW TO USE THIS MANUAL

This manual:

Contains instructions for safe and efficient operation of the Mine Resistant Vehicle Category I and Category II, manufactured by International Military and Government, L.L.C. Protection, Inc.

This manual has five chapters that contain sections with alpha/numeric pages. Use the table of contents for reference and quick access.

There are three types of notations: Warnings- are posted in the summary and prior to text that cover any area that would present a situation that may result in injury or death, compliance is mandatory. Cautions- will be found on the same page and preceding the text covering any area that would present a situation that may result in damage to equipment. Notes - will precede text to alter normal procedures or point out areas of concern.

The manual consists of:

Front Matter - a cover page, copyright release, warning summary, how to use this manual, and recommended manual improvements.

Chapter 1 - provides General Information, Equipment Description, and Theory of Operation.

Chapter 2 - contains Operator Instructions.

Chapter 3 - provides Troubleshooting Procedures for operator/crew.

Chapter 4 - contains Preventive Maintenance Checks and Services (PMCS) instructions for Before, During, After, Weekly, and Monthly checks.

Chapter 5 - provides Maintenance Instructions for the Operator.

Appendix A - the abbreviation or acronyms for a particular part or service procedure are followed by definitions.

Appendix B - Lubrication Instructions

Appendix C - this appendix lists expendable and durable items.

Appendix D - this appendix lists Basic Issue Items (BII) for the I-MPV to help you inventory the items for safe and efficient operation of the equipment.

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Chapter 1 – GENERAL INFORMATION, EQUIPMENT DESCRIPTION, AND THEORY OF OPERATION

1-1. General Information

SCOPE

This COTS manual contains instructions for the operation of Mine Resistant Vehicle, Preventative Maintenance Checks and Service (PMCS) associated with IMP MRAP, operator troubleshooting procedures and maintenance instructions.

MAINTENANCE FORMS AND PROCEDURES

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by (as applicable) DA PAM 738-750, Functional Users Manual for The Army Maintenance Management System (TAMMS).

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

If your vehicle needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368 (Product Quality Deficiency Report). Mail it to us at: Commander, U.S. Army Tank-Automotive and Armaments Command, ATTN: AMSTA-LC-GMM, Warren, MI 48397-5000. We'll send you a reply.

CORROSION PREVENTION AND CONTROL (CPC)

A corrosive environment includes exposure to high humidity, salt spray, road de-icing chemicals, gravel damage, and atmospheric contamination. No action beyond normal washing and repair of damaged areas is needed to control corrosion. To prevent moisture accumulation, drain holes are provided on structural and sheet metal areas where needed, and stowage boxes are provided with seals and baffled drains.

Corrosion Prevention and Control (CPC) of Army materiel is a continuing concern. It is important that any corrosion problems with the vehicle be reported so that the problem can be corrected and improvements made to prevent the problem in future items.

While corrosion is typically associated with rusting of metals, it can also include deterioration of other materials, such as rubber and plastic. Unusual cracking, softening, swelling, or breaking of these materials may be a corrosion problem.

If a corrosion problem is identified, it can be reported using form SF 368 (Product Quality Deficiency Report). Use of key words such as "corrosion", "rust", "deterioration", or "cracking" will ensure that the information is identified as a CPC problem.

The form should be submitted to the address specified: Commander, U.S. Army Tank-Automotive and Armaments Command, ATTN: AMSTA-LC-GMM, Warren, MI 48397-5000.

DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

Command decision, according to the tactical situation, will determine when the using organization is to destroy a vehicle. A destruction plan will be prepared by the using organization, unless one was prepared by a higher authority. For general vehicle destruction procedures, refer to TM 750-244-6, Procedures for Destruction of Tank-Automotive Equipment to Prevent Enemy Use (U.S. Army Tank-Automotive and Armaments Command).

1-2. Equipment Description

(a) Characteristics Category I and Category II Vehicles

The International® Mine Protected Vehicle (I-MPV) enhances the effectiveness of ground combat forces in stability operations against unconventional enemy forces. The vehicle provides its occupants with enhanced personnel protection when operating in this environment. The vehicles transportation capability allows ground combat forces to travel farther, carry more payloads, and remain engaged longer than was possible with previous vehicles.

The vehicle is designed to increase survivability. The primary mission of the vehicle is to provide ground mobility capable of operating in a threat environment involving ambushes employing the use of mines, Improvised Explosive Devices (IED), Rocket Propelled Grenades (RPG), and Small Arms Fire (SAF). The vehicle will operate in most weather and terrain conditions, including off-road operation and obstacles such as debris. The vehicle will be used for troop transport, ambulance, and combat engineering.

The major systems of the I-MPV include the cab, engine, transmission, drive train, electrical system, pneumatic system, suspension, steering, and winch. The vehicle additionally features a V-shaped hull, raised chassis, integral armor, blow-off wheels, and axles to provide increased survivability by improved mine and IED protection.

Each vehicle is capable of carrying a driver and five to nine troops. The vehicle is also capable of carrying a manned top-mounted machine gun. Firing ports and viewing ports with transparent armor are available for the remaining infantry troops to employ their individual weapons. The vehicle is equipped with an intercom (Interactive Communication System - ICS) and will normally carry radios for communications to higher, adjacent, and supporting units.

Category I:

The Category I vehicle is the smaller of the I-MVP vehicles, capable of carrying six persons including the driver. The vehicle is four-wheel drive with a curb weight of 21,000 to 32,000 lb and a GVW or 31,300 to 52,000 lb. The vehicle is designed for small unit combat operations in urban or confined areas including:

- Mounted patrols
- Convoy security
- Casualty evacuation
- Reconnaissance
- Communications
- Command and control
- Troop and cargo transport
- Direct interaction with civilian population

Category II:

The Category II vehicle is capable of carrying ten persons including the driver. The vehicle is four-wheel drive with a curb weight of 26,600 to 40,000 lb and a GVW of 31,300 to 52,000 lb. The vehicle is designed for ground logistic support operations such as:

- Convoy lead and escort
- Troop and cargo transport
- Ambulance
- Explosive Ordnance Disposal (EOD)
- Combat Engineering Operations

(b) Vehicle Capabilities for Category I and Category II

The vehicles have the capability of communicating with other vehicles to locate, prevent, and defend against the effects of mines and IED. The vehicles integrate communications equipment including:

- DOD tactical radios
- Satellite communication
- Jammers
- Intercom

The vehicle can contain situational awareness systems to assist in avoiding mines and IED by identification of friendly versus enemy forces and knowledge of location of potential hazards relative to the vehicle position.

- The vehicle is also capable of:
- Operating in temperatures ranging from -25 to +125ºF (-32 to +52ºC) without arctic kits.
- Water fording up to 36 in. (91.44 cm) deep.
- Climbing and descending 60 percent grades.

(c) Armor Capabilities

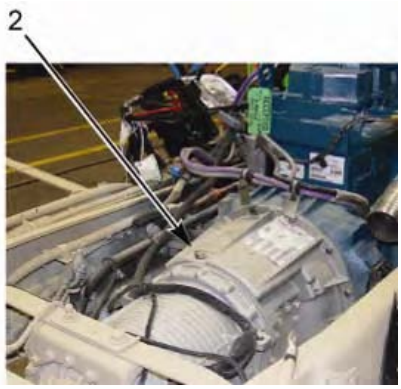
This vehicle provides integral protection for the crew from blast, shock, fragments, and effects of mine blast. It provides crew protection even when a mine is detonated under any wheel or directly under the crew compartment. The vehicle provides crew survivability against antitank mines, small arms fire, IED, and overhead airburst. Additional crew protection is provided by the four-point restrain system and shock absorbing seats. This vehicle has 360 degrees rollover protection.

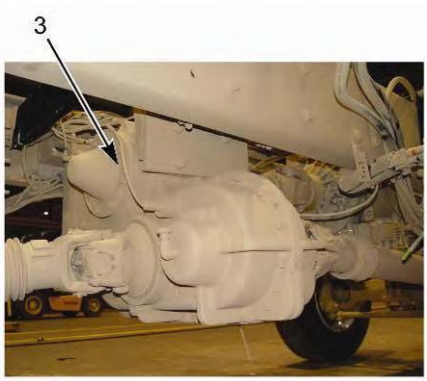
(d) Vehicle Features (as of 15 August 2007)

- Antilock Brake System (ABS)
- Air Conditioning (AC)
- Front and rear towing eyes
- Fire Suppression System (FSS)
- Run flat tires
- Four-point restraining seating system
- Intra-vehicle intercom system
- Blackout lighting and night vision capabilities
- NBC (Nuclear, Biological, or Chemical) overpressure system
- Electric winch
- Weapon mounting capability
- Remote controlled spotlight
- Remote controlled/heated mirrors
- Tilt steering wheel
- Two-speed with interval windshield wipers and washers

1-3. Location and Description of Major Components

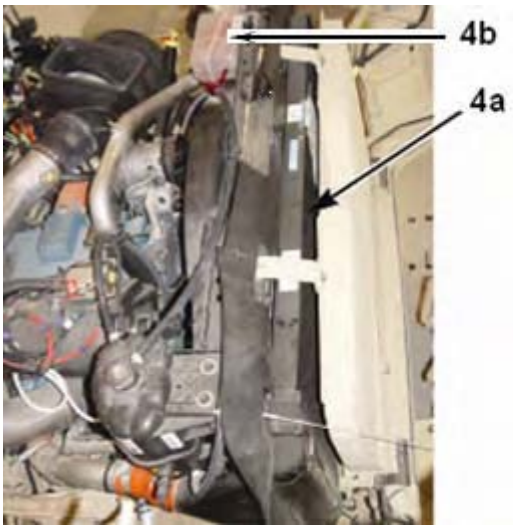
(a) Drivetrain





The I-MPV is powered by an International® DT 530, in-line six-cylinder, fuel-injected, diesel engine (1). The engine is coupled with a 3000SP, five-speed automatic transmission (2). The engine and transmission are coupled to a two-speed transfer case (3).

(b) Cooling System

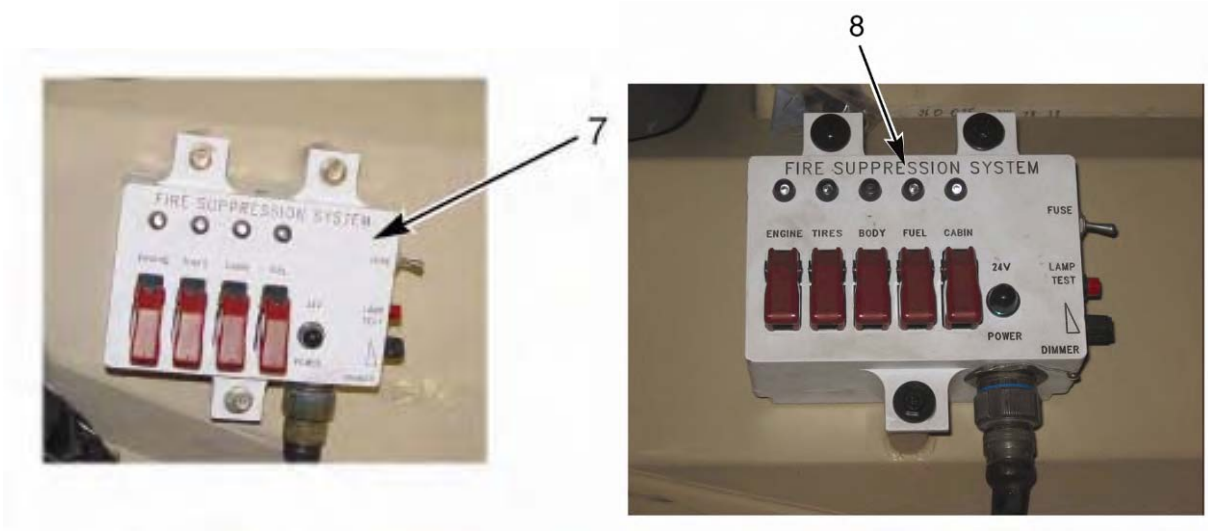


The cooling system consists of a radiator (4a), fill reservoir (4b) and surge tank (5). The cooling system keeps the engine from overheating and is located in front of the engine. The radiator cools the fluids that run through the engine and transmission to keep the vehicle running and moving. The coolant runs through separate passages in the engine to cool it down. The coolant is sent back to the radiator to cool it off before sending it back through the engine again. The transmission cooler attached to the radiator cools the transmission fluid. The coolant will heat the interior of the vehicle when the heater is turned ON. This will also pull heat away from the engine, cooling it off.

(c) Heating, Cooling, and Air Conditioning/Life Support System (HVAC/LSS)

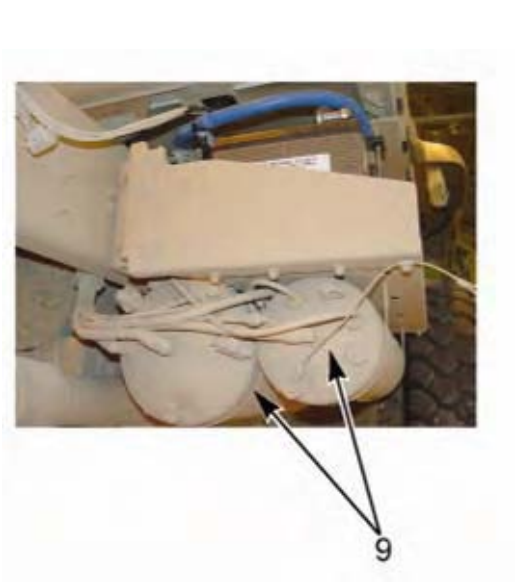
The HVAC/LSS (6) regulates the fresh and re-circulated air within the cabin. It provides protection from outside extreme hot or cold temperatures. Fresh air is received into the vehicle's cabin through an inlet located on the vehicle's roof. The pre-treated air then moves through an evaporator and a heater, where fresh air is mixed with recycled air. A blower injects the treated air into the cabin. (In wartime configuration, the system provides protection from nuclear, biological, and chemical agents by a special filter.)

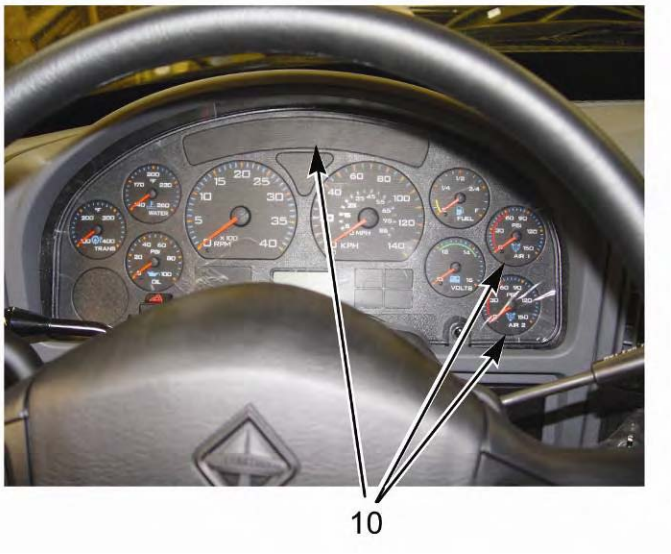
(d) Fire Suppression System (FSS)



This vehicle is equipped with a fire suppression system Category I (7) or Category II (8). Control box is located between driver and passenger on the control console. The cabin, engine, tires, body, and fuel tank are protected with the fire suppression systems. Only the cabin and engine systems are automatic. All these systems can be operated manually by the driver of the vehicle in case of malfunction in automatic systems. There are different systems for different areas; water mist for cabin, HFC227ea Clean Agent for engine, Petrotech TM25 for tires, AFSS foam water spray for the body, and an AFSS system for fuel tank. The body system is not present on the Category I vehicles.

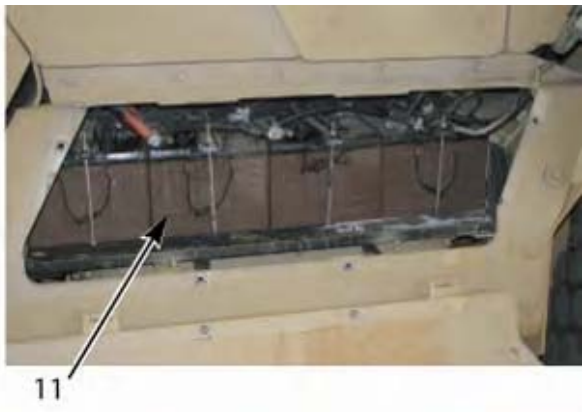
(e) Pneumatic (Air) System

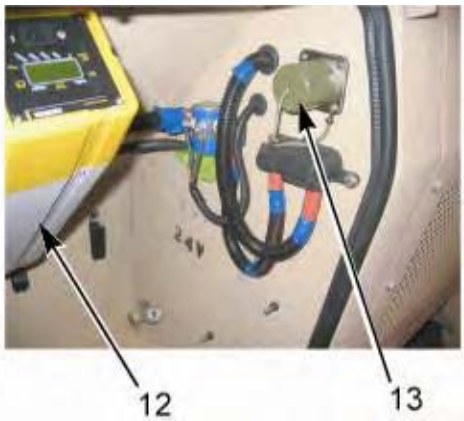




This vehicle is equipped with air brakes, two air tanks (9), dash gauges and warning lights (10), and sounds to let you know if there is a problem with the air system. The air tanks can also provide a means of inflating the tires. The pneumatics (air) also assists in the opening and closing of cab doors.

(f) Electrical System





The electrical system on this vehicle is run by a 400 amp 24V alternator which runs the vehicle while the engine is operating and charges the four 12V batteries (11). This charging is accomplished through equalization. The batteries are hooked in series-parallel and are located under the right hand passenger front side of vehicle, in a box on top of the two air tanks. These batteries provide 12 or 24V power. The 110V (12) power inverter box is for assisted powering with auxiliary equipment. It is located next to the Slave receptacle (13) used to start a disabled vehicle, they are located in the right front exterior stowage box.

(g) Hydraulic System

There is a hydraulic system (14) located in the rear of the vehicle which is part of the rear troop door/ramp. A panel above the door contains a toggle switch to supply hydraulic power to operate the door/ramp. There are also controls in the driver area for the operation of the door/ramp. The door/ramp can also be raised manually using the hydraulic system.

1-4. Equipment Specifications

Refer to the following tables for specific equipment data.

Dimensions Table

Ground Clearance	Specification
Cross-Country	14 in. (35.56 cm)
Highway	16.7 in. (42.4 cm)

Capacities Table

Item	Specification
Engine Oil with Filter	30 qt (28.3L) 15W40 CI-4
Cooling System	88 qt Extended Life Coolant (ELC)
Transmission with Filter – Dry	29 qt TransSynd (TES-295)
Transmission with Filter – Drain and Refill	19 qt TransSynd (TES-295)
Axle - Front	18 qt (17 L) - (85W140)
Axle - Rear	19.5 qt (18.5 L) - (85W140)
Wheel Ends	1.6 qt (1.5 L)
Rear Door/Ramp Hydraulic Fluid	6.5 qt AW30
Power Steering Reservoir	5.5 qt - (15W-40)
Transfer Case w/o cooler	4.5 qt - SAE 50W (O-81)
Windshield Wiper Fluid	4 qt (3.7 L) Solvent
AC System	6.5 lb (R134A)

Cooling System Table

Item	Specification
Radiator Working Pressure	15 psi (103 kPa) low idle

Engine Configuration Table

Item	Specification
Make	International®
Model	DT 530 ST
Type	Four-stroke, In-line
Cylinders	Six
Bore	4.59 in. (116.5 mm)
Stroke	5.35 in. (135.9 mm)
Displacement	530 cu-in. (8.7 L)
Peak Torque	950 lb-ft @ 1200 rpm
Maximum Brake Horsepower (at 2,000 rpm)	330 hp
Maximum Governed Engine Speed	2,200 rpm

Oil Filter Table

Item	Specification
Type	Full flow, Spin-on
Quantity	1
Oil Pressure	40-70 psi (276-483 kPa)

Fuel System Configuration Table

Item	Specification
Type	Diesel Injection (electronically controlled)
Tank Quantity	70 gal. (265 L)
Air Cleaner	Dual Element
Fuel Type	Diesel or JP8
Fuel Pressure	45 psi (310 kPa)

Electrical System Table

Item	Specification
Alternator	Niehoff N/1602-1 24V
System amps	400
Rotation	Reversible

RPM Rated Output Table

Item	Specification
Recommended Speed	8,000 rpm
Over-speed	10,000 rpm
Drive Type	Pulley
RFI Suppression Ability	Yes
Batteries	650 CCA Exide
Quantity	4 each
Voltage, each	12V
Connection	Series-parallel

Transmission Table

Item	Specification
Make	Allison
Model	3000SP five-speed
Type	Automatic Electronic Control, WTEC III – Gen lV

Transmission Speeds Table

Item	Specification
Forward	Five
Reverse	One

Transfer Case Table

Item	Specification
Make	Meritor
Model	T-4210
Type	Two-speed with NEUTRAL (N)

Axles Table

Item	Specification
Front	MX-18-120 / 18,000 lb - Meritor
Rear (Category I)	RS-21-160 / 21,000 lb - Meritor
Rear (Category II)	RS-23-160 / 23,000 lb - Meritor

Brake System Table

Item	Specification
Actuation	Air
Number of Brake Chambers	2 per axle, rear also equipped with spring brakes
Type	S Cam
Front	Bendix Shoes - 16.5 x 7
Rear	Bendix Shoes - 16.5 x 7
Air Compressor	Bendix
Number of Cylinders	2; Bendix 922
Cylinder Configuration	In-line
Displacement	31.4 CFM
Air Dryer	Bendix Model # 3562656C91
Truck Air System	120-130 psi (827-896 kPa)
System Operating Pressure	70 Max Pressure

Wheels Table

Item	Specification
Type	Two-piece bolt together
Quantity	4
Rim Size	22.5 x 8.25
Stud Quantity per Wheel	10
Lug nut Torque	350-400 lb-ft (475-543 N•m)
Space Plate Torque	175-200 lb-ft

Tires Table

Item	Specification
Type	Tubeless
Quantity	4 per vehicle
Tire Model	XZL
Size	385 16 R20
Load Range	M
Tire Pressure	Category l 95 psi / Category ll 115 psi

Towing and Lifting Table

Item	Specification
Quantity	4 (2 front, 2 rear)
Maximum Load Capacity	N/A
Pintle Hook	49,000 lb
Front Tie Down Eyes	49,000 lb
Rear Tie Down Eyes	49,000 lb
Front Tow Eyes	61,500 lb
Forward Lifting Eyes	30,500 lb
Front Hook for towing	15,000 lb

Cab Table

Item	Specification
Windshield	Transparent Armor
Personnel Capacity	8 person Category I / 10 person Category II

Winch Table

Item	Specification
Make	Warn
Model	18 Series
Electric Winch powered by	Mega Fuse behind battery box

Wire Rope Table

Item	Specification
Diameter	5/8 in. (15.9 mm)
Length	70 ft (21.4 m)
Ultimate Strength	40,000 lb (18,144 kg)
Working Load	18,000 lb (8,172 kg)

Line Pull Ratings Table

Item	Specification
1st Layer (five wraps minimum)	22,000 lb (9,988 kg)
2nd Layer	19,800 lb (8,989 kg)

Filter Section Table

Item	Specification
Fresh Air Filter	3532800C1
Water Filter	3554348F91
Fuel/Water Filter	1618386C93
Oil Filter	1833121C1
Air Conditioner Filter	3542577C2
Secondary Air Filter	3532801C1
Fuel Filter	1677004C94
Power Steering Oil Filter	2503221C1
High Pressure Pump Filter	1825238C1
Air Cooler Cartridge Filter	2500518C91

1-5. Principles of Operation – System Overview

(a) Hydraulic System (Rear Door/Ramp)

Hydraulics are used to open and close the rear door/ramp of the vehicle. A dash-mounted toggle switch allows the driver to operate the door/ramp automatically. In the event of electrical failure or hydraulic failure or for an emergency exit the door can be lowered/raised using a manual release and a handle for the manual hydraulic pump. In a total failure, the rear ramp door, will free-fall.

(b) Electrical System

The vehicle has a dual electrical system that consists of a 24V alternator, starter, and four batteries that are configured in a series parallel configuration, which provides 12 or 24V power. The vehicle is equipped with a power inverter that supplies 110V AC, with a 110V outlet.

(c) Pneumatic (Air) System

The pneumatic system consists of air brakes and air assistance for the vehicle's doors.

Opening and closing of the vehicle's armor-enforced doors is assisted by pneumatic cylinders mounted inside each of the side doors.

There are two air brake chambers per axle. The rear axle also has spring-applied parking brakes. The system has two air supply tanks. One tank supplies air for the front (secondary) brake system. The other supplies air to the rear (primary) brakes. The air is supplied from an engine driven air compressor.

The air compressor compresses air to do the work of brake application. The driver operates a valve that controls air pressure to the brakes, and the pressure is determined by the driver's pedal stroke.

(d) Heating, Ventilation, and Air-Conditioning (HVAC)/Life Support System (LLS)

The vehicle's heating, ventilation, and air-conditioning (HVAC) system provides a comfortable cab environment by controlling temperature and humidity. It also features a special filtration system that protects the vehicle occupants from dust and chemical or biological contaminants.

The HVAC unit is inside the vehicle, on the cab's right side wall, behind the front passenger seat. The NBC filter is accessed externally.

Vehicle occupants can control the HVAC system functions with a mode selection panel, located directly behind the front seats. Controls consist of a group of switches.

(e) Fire Suppression System (FSS)

The vehicle is equipped with multiple sensor-operated and crew-activated fire suppression systems (FSS) that protect the cab and its occupants, the engine, the tires, the vehicle body, the outside of the vehicle, and the fuel tank.

The controls for the FSS are located between the driver's and front passenger's seats, and can also be accessed and activated by the crew. Occupants can easily activate any of the FSS switches by lifting the cover of the desired switch, and toggling the switch UP to activate the specific system.

There are five subsystems: cab protection, engine protection, tire protection, body protection, and fuel tank protection. The cab and engine protection systems can be operated automatically or manually. The other three systems only operate manually. The cab protection system is a water mist spray system without chemical additives, designed to protect occupants from extreme heat for a period of 3 minutes.

The Category I vehicle has only the engine, interior, fuel and tire protection system. The Category II vehicle has all five systems.

(f) Drivetrain

This vehicle is equipped with a DT530 in-line six-cylinder, fuel-injected, diesel engine, a five-speed automatic transmission, and a two-speed transfer case. These components move the vehicle forward, backward, and into LOW range in severe conditions. The output from the transfer case drives the rear differential when in two-wheel drive, and drives the front and rear differentials in four-wheel drive. The vehicle must be brought to a full stop to engage four-wheel drive or shift the transfer case from HIGH to LOW. The vehicle will not move if the transfer case is in NEUTRAL (N).

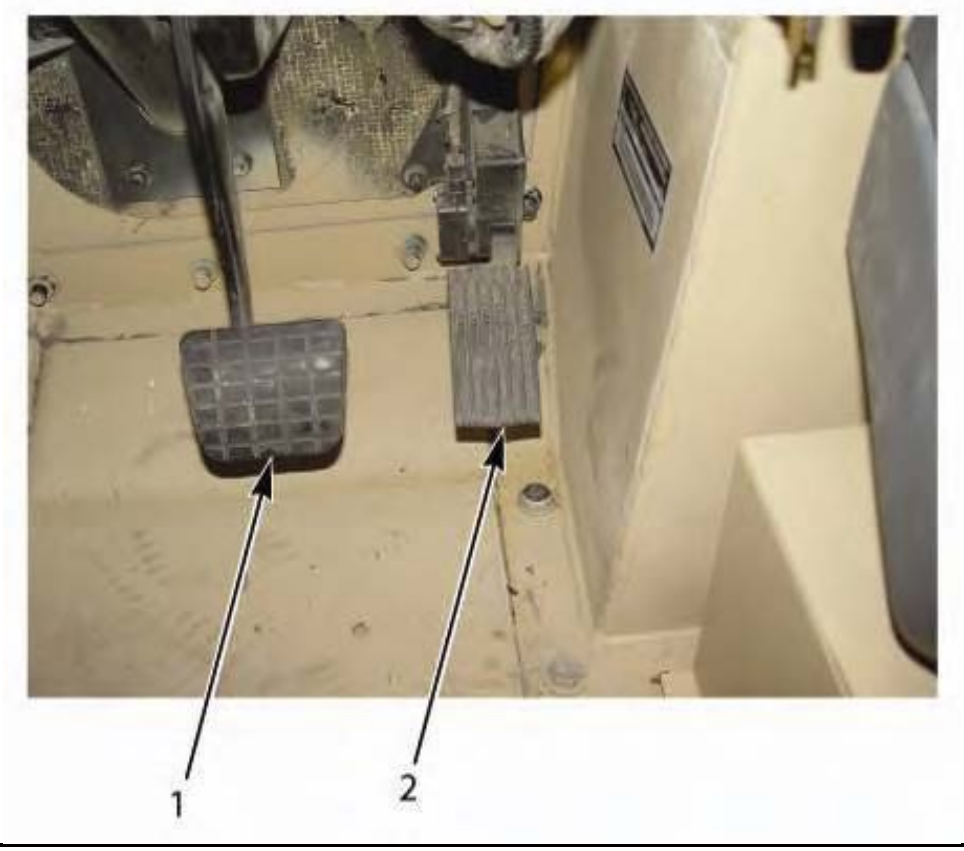
1-6. Location and Use of Features, Controls and Indicators

This section shows the locations and describes the use of controls and indicators used to operate the I-MPV.

Know the location and proper use of every control and indicator before operating the I-MPV. Use this section to learn about each control and indicator. Separate illustrations with keys are provided for each group of controls and indicators.

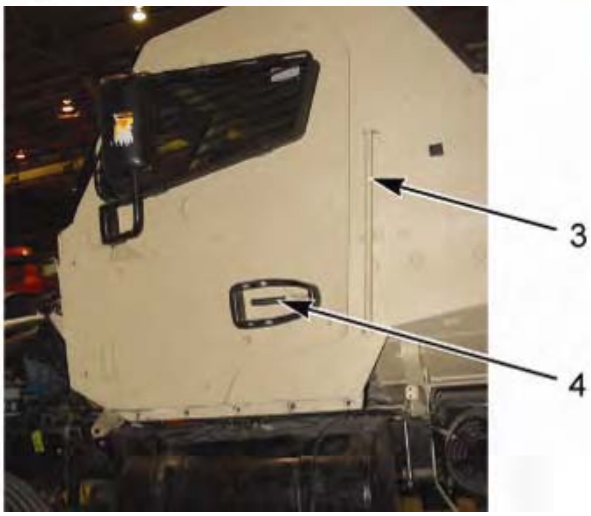
(a) Cabin Mounted Foot Controls

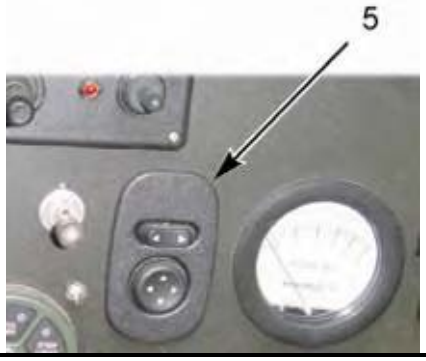
Key	Control or Indicator	Function
1	Service Brake Pedal	Applies service brakes. Apply pressure to stop.
2	Throttle Control	Controls engine speed. Apply pressure to go.



(b) Cabin Mounted Hand Controls

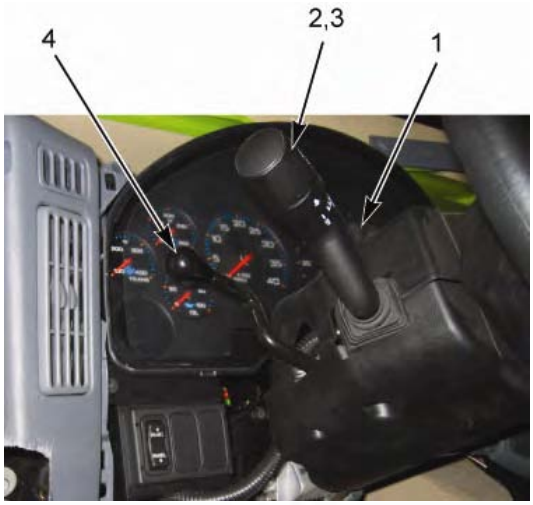
Key	Control or Indicator	Function
1	Cab Door Handle	Pull lever to open cab door from inside of cab.
2	Combat Lock	To secure door from being opened from outside.
3	Grab Handle	Used to assist in entry and exit of cab.
4	Cab Door Outside Handle	Pull to open cab door from outside of cab.
5	Mirror Controls	Allows driver to adjust both side mirrors.

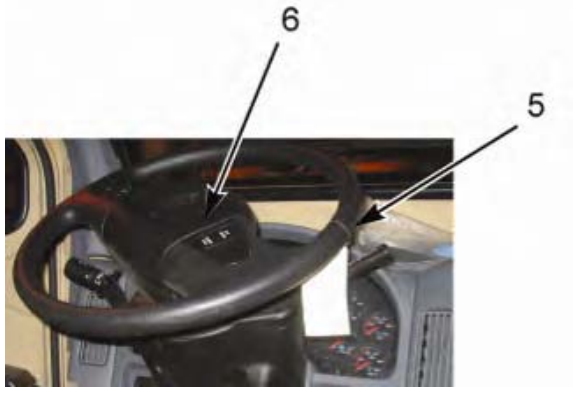




(c) Steering Column Mounted Controls

Key	Control or Indicator	Function
1	Emergency Flasher Control	To turn on hazard warning flashers, push button in. To turn off hazard warning flashers, pull button out.
2	Turn Signal Lever	Push up to signal right turn. Pull down to signal left turn. When turn is completed, lever will automatically return to off position.
3	Head Light Dimmer Lever	Pull directional lever to activate headlight beams. High beam indicator on dash will illuminate BLUE when high beams are on.
4	Steering Wheel Tilt Adjustment Lever	Pull lever forward to adjust steering wheel. Release lever when adjustment is complete.
5	Steering Wheel	Controls direction of vehicle.
6	Horn	Press the center of the steering wheel to sound the city horn.



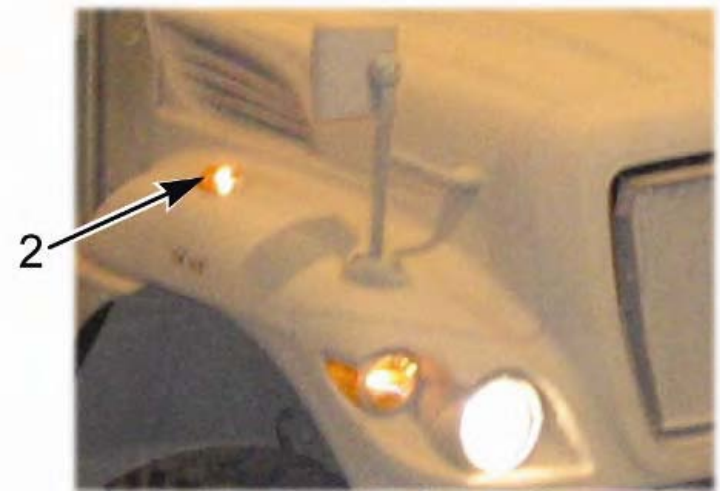


(d) Instrument Panel Controls and Indicators

The instrument cluster includes the instrument gauges, warning indicators, and an Integral Digital Display, that provides odometer and transmission gear indication. This instrument cluster displays the crucial operational functions of the vehicle.

(e) Master Vehicle Light Switch (MVLS)

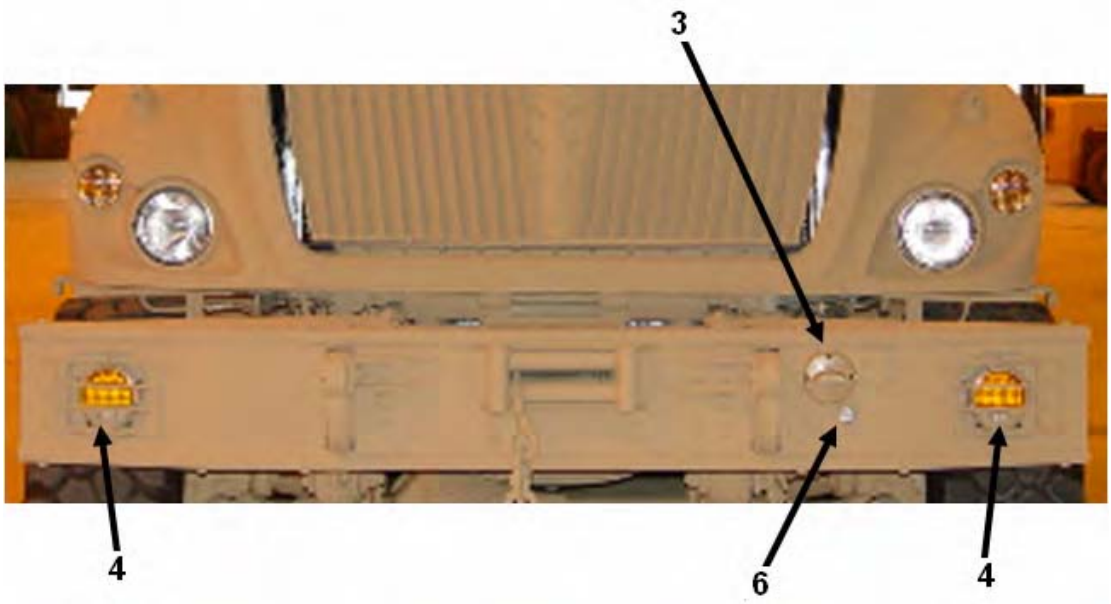
Vehicle lights are controlled by the Master Vehicle Light Switch (MVLS) (1) located on the center instrument panel. The MVLS controls the following lights.

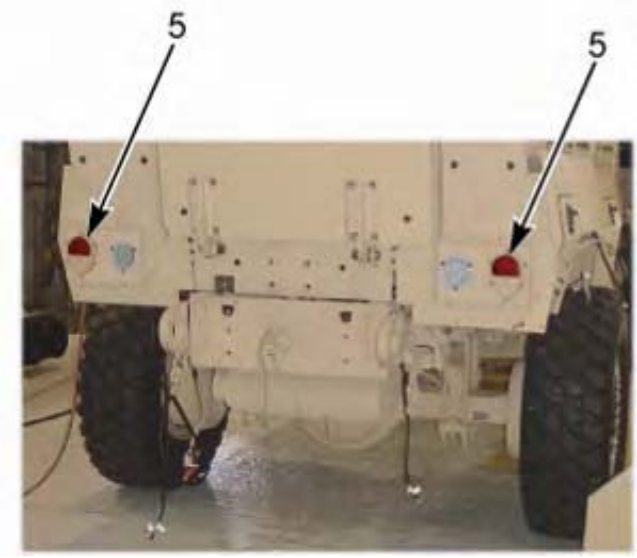


Marker lights (2) are located on the vehicle's fenders.

Blackout light (3) is located on the left front corner of front bumper. There are four blackout marker lights, two on front bumper (4) and two on the rear (5). They are located on the left and right edges of the vehicle's bumpers.

An I.R. lamp (6) is located on the left side of the front bumper.





Chapter 1 – General Information, Equipment Description, and Theory of Operation

1. Switch Key Board Function

B.O. DRIVE (1) – Normal Black Out night time driving mode. Will turn on; the blackout headlights, clearance lights, marker lights, tail lights, turn signals, etc.

B.O. MARKER (2) – Same lights as B.O. Drive except B.O headlamps are off.

ALL OFF (3) – Turns OFF all vehicle lights.

STOP LIGHT (4) – Normal daytime operation of the vehicle lights. Still allows operation of the vehicle's stop lamps and turn signals.

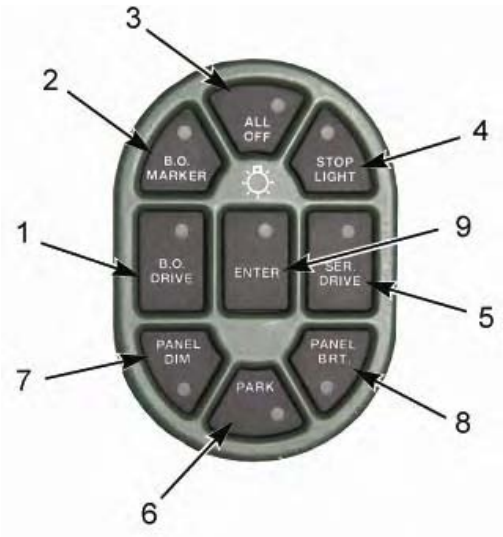
SERVICE DRIVE (5) – Normal night time driving mode of vehicle using headlamps

PARK (6) – Normal twilight operation of the vehicle's lighting, using parking lights instead of headlamps.

PANEL DIM (7) – Dims the panel display

PANEL BRT (8) – Brightens the panel display

ENTER (9) – Inputs the mode selected



2. Operation Instructions

INITIALIZE:

Press any key (lightning will flash once).

MODE SELECT:

Press desired mode/function (key will flash).

Press ENTER.

NOTE

If enter is not pressed within 5 seconds, switch will reset to previous mode. This prevents accidental switching.

OFF:

Press ALL OFF key.

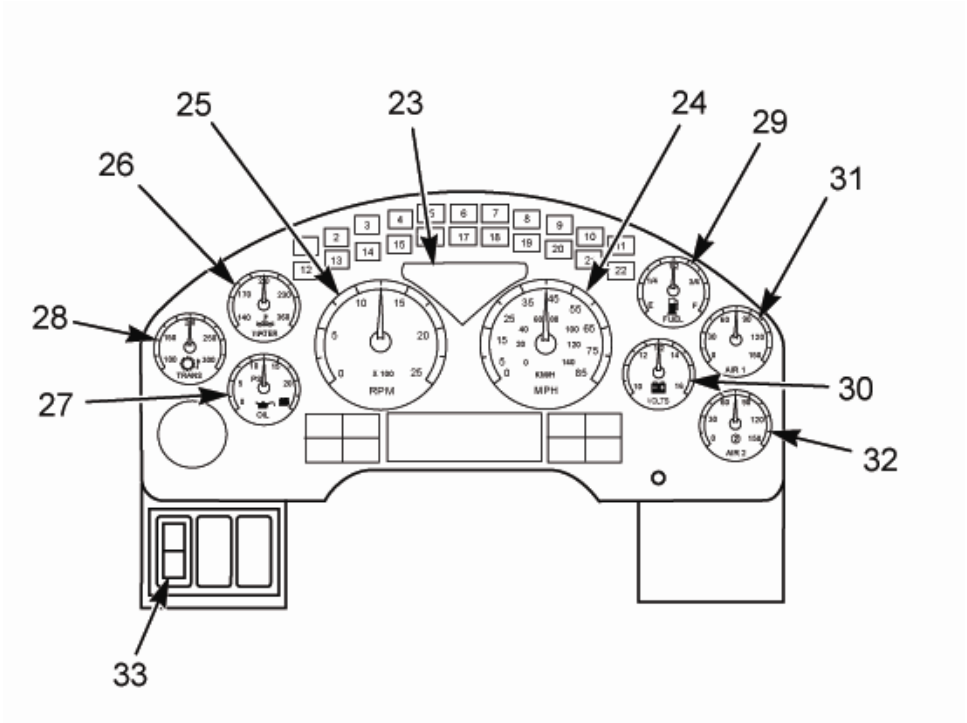
Press ENTER. (Switch will turn off after 20 seconds).

NOTE

If there are no blue indicators lighted, then no external vehicle lights are turned on. Amber backlight is for keypad illumination only.

(f) Warning Indicators

The gauge cluster may contain as many as 25 individual LED warning indicators. These indicators are used to alert the driver of vehicle conditions and functions and may indicate a WARNING or STOP condition. These warning indicators are driven by the software in the cluster. At ignition, the warning lights will illuminate for 8 to 10 seconds, as part of the vehicle power-up sequence.



NOTE

Callouts No. 1 thru 22, discussed in the Instrument Panel Controls and Indicators table, are not shown. Callouts No. 1 thru 22 are the small rectangles shown in the upper middle section of the dash. Callouts No. 1 thru 11 are in the top row of rectangles and are read left to right. Callouts No. 12 thru 22 are in the bottom row of rectangles and are read from left to right.

Instrument Panel Controls and Indicator Table

Callout	Item	Description
1	RANGE INHIBITED	Illuminates AMBER when the transmission is not engaged in the selected gear. The warning light goes out when the gearshift lever/button is adjusted to the appropriate gear.
2	PROTECT LAMP	Illuminates AMBER when coolant or engine oil levels are less than or equal to 80%. If turned on by another component, will be accompanied by a text message in the Integrated Digital Display.
4	AMBER ENGINE WARNING	Illuminates AMBER in conjunction with other warning lights.
5	RED ENGINE STOP	Illuminates RED in conjunction with other warning lights or General Text and Warning Messages to indicate a RED STOP alert.
7	PARK	Illuminates RED when the parking brake is applied. If the brake warning lamp does not illuminate, or if it stays on with the parking brake not engaged, seek service immediately.
21	**ABS** (Antilock Braking System)	Illuminates AMBER when an antilock brake system malfunction has been detected. If the ABS light stays illuminated or continues to flash, have the system serviced immediately.
23 **Triangle located on center of dash below LED indicators**	LEFT ARROW (On top left of center triangle)	Flashes GREEN when the left turn signal or the hazard lights are turned ON.
	HIGH BEAM (On bottom of center triangle)	Illuminates BLUE when the high beam head lamps are turned ON.
	RIGHT ARROW (On top right of center triangle)	Flashes GREEN when the right turn signal or the hazard lights are turned ON.

(g) Gauges and Dimmer Switch

There are nine gauges in the instrument cluster, hereafter called the Electronic Gauge Cluster (EGC). Most gauges have in-gauge warning lights which turn on if the gauge value goes above or below the warning indicator threshold. When the ignition switch is turned ON, the gauge pointer position will be initialized at the lowest pointer stop.

Gauge Table

Callout	Item	Description
24	SPEEDOMETER GAUGE	Indicates the vehicle speed in miles per hour.
25	TACHOMETER GAUGE	Indicates the engine speed in revolutions per minute.
26	COOLANT TEMP GAUGE	Indicates the engine coolant temperature. The warning light indicates the engine coolant temperature has exceeded 230°F (110°C) when equipped with a 10 psi surge tank, and 235°F (113°C) when equipped with a 15 psi surge tank. If the warning light is activated, stop the vehicle as soon as possible, turn the engine OFF and let it cool.
27	OIL PRESSURE GAUGE	Indicates engine oil pressure. If the needle falls below the normal range 20 to 65 psi (138 to 448 kPa) at normal operating temperature, stop the vehicle as soon as safely possible, and check the engine oil level. The gauge warning light indicates low engine oil.
28	TRANSMISSION OIL TEMP GAUGE	Indicates the transmission lubricant temperature in degrees Fahrenheit and Celsius.
29	FUEL GAUGE	Indicates the approximate fuel level in the fuel tank. If the vehicle is equipped with dual fuel tanks, the fuel gauge reads the fuel level only from the primary (draw) fuel tank. When the fuel level reaches approximately 1/8 full, the gauge warning light will illuminate and an audible alarm will sound (5 beeps). If equipped – Special Fuel Warning; the warning light will illuminate when the gauge falls below 1/3 of a tank and the alarm will continuously sound when gauge falls below 1/10 of a tank (close to “E”).
30	BATTERY VOLTAGE GAUGE 12V side only	Indicates the battery voltage when the switch is in the ON position and the engine is running. The warning light illuminates when the battery voltage is too high or low. This is for the 12V side only. There is a separate gauge for 24V.
31	AIR PRESSURE GAUGE #1	Provides indication of the air pressure available for the primary air brakes. The gauge warning light and under – limit audible alarm will indicate when the air pressure is less than 70 psi (483 kPa).
32	AIR PRESSURE GAUGE #2	Provides indication of the air pressure available for the secondary air brakes. The gauge warning light and under – limit audible alarm will indicate when the air pressure is less than 70 psi (483 kPa).
33	PANEL DIMMER SWITCH	Controls the brightness of the LCD (odometer) display.

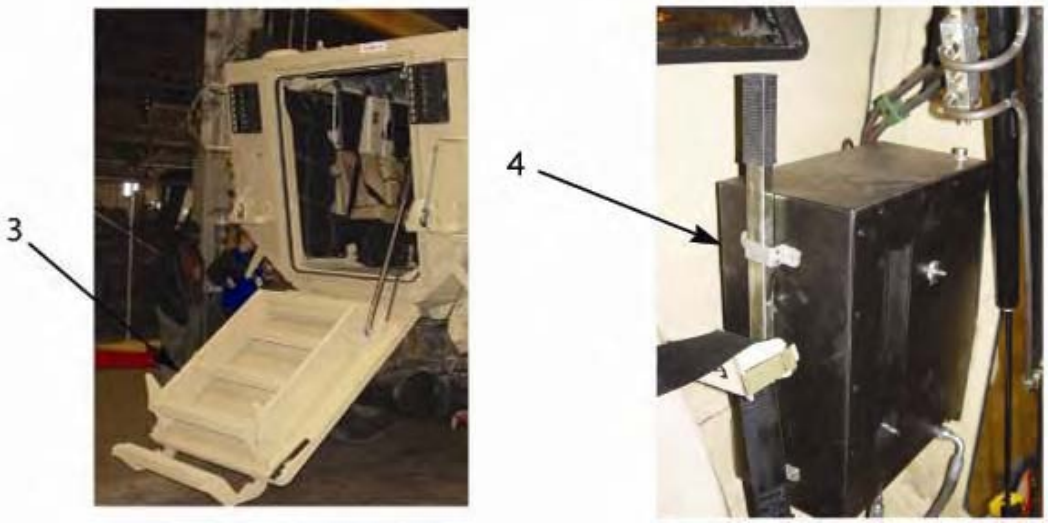
(h) Doors, Gun Ports and Hatches

1. Doors

Before attempting to open the door make sure the combat latch (1) is released by lifting the handle.

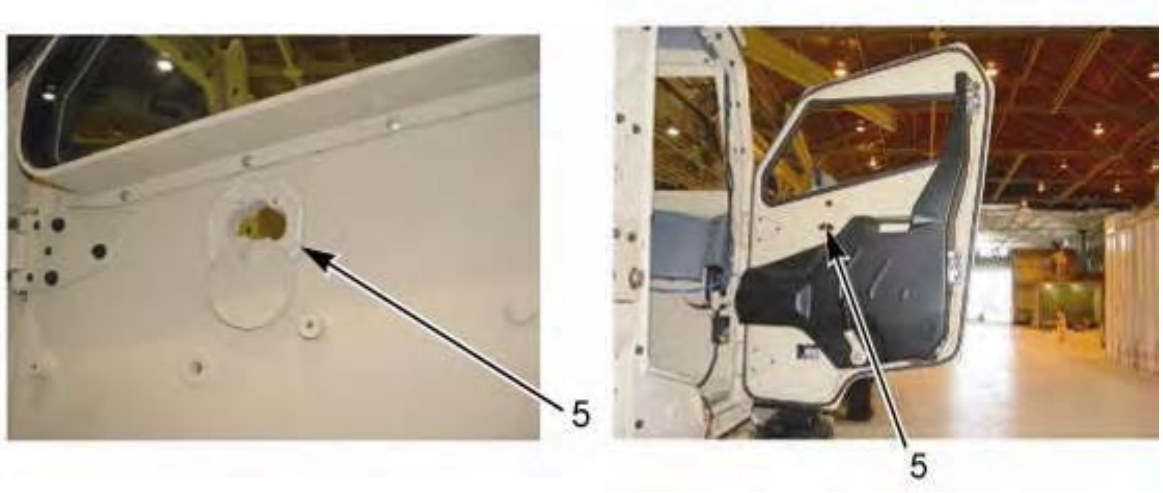
To open the door simply push the inside door handle (2) towards the outside and push open the door.

Vehicle armor and windows are fixed. No operator involvement is required. The armored windows on the vehicle are bolted on, fixed transparent material and do not open. Ventilation is provided by the HVAC/LSS.



The rear door/ramp (3) is operated by hydraulic pressure, or can be operated manually (4) in an emergency. The door/ramp is designed to allow fully equipped troops to easily exit and enter the vehicle.

2. Gun Ports



Category I vehicles features six gun ports (5) (three on each side of the vehicle) and Category II vehicles feature eight gun ports (four on each side of the vehicle).

The gun ports can be opened and sealed from inside the vehicle without the use of tools.

3. Hatches

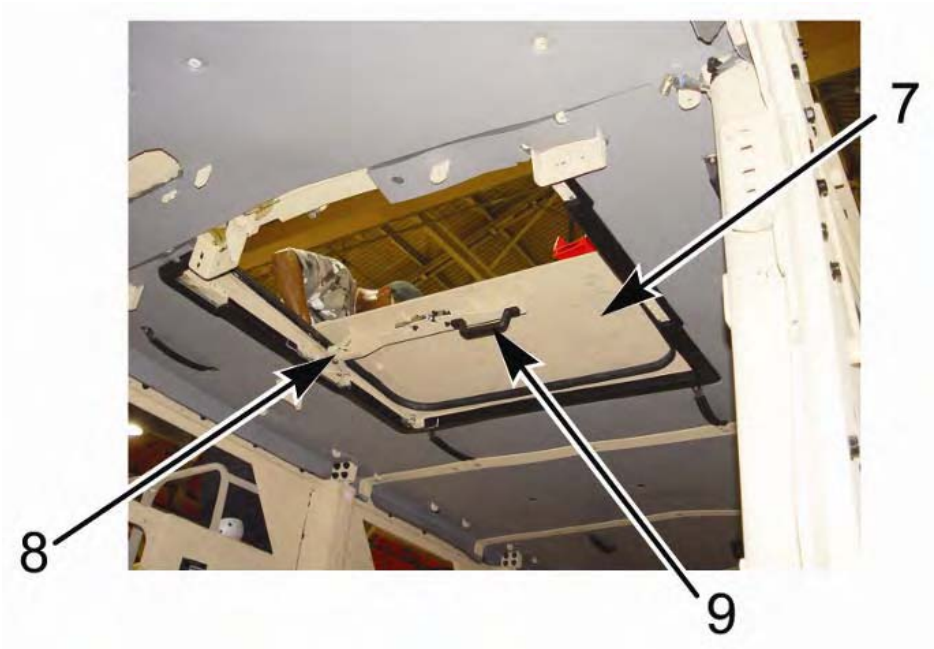
WARNING

Vehicle must not be operated with the Emergency roof hatch open. Keep arms, hands and head clear of Emergency roof hatch when closing it. Failure to comply may result in serious injury or death to personnel.

The emergency roof hatch (6) in the rear of the vehicle offers exit in the event of a rollover where the front driver or passenger doors, or rear door/ramp hatch are not available. The roof hatch is opened manually by a black handle, and closed with a clamp.

WARNING

Ensure that the gunners hatch is in the locked position before moving the vehicle. Use extreme caution when standing in gunner's hatch while vehicle is in motion; gunner should be holding onto the weapon or other suitable handle to maintain a stable posture at all times. Failure to comply may result in serious injury or death to personnel.



WARNING

The gunner's sliding hatch can only be opened or closed when the vehicle is stationary and on a level surface. DO NOT attempt to open or close the hatch when the vehicle is in motion. Keep arms and hands clear of gunners hatch when closing it. Failure to comply may result in serious injury or death to personnel.

Roof hatches are heavy. Use caution when opening or closing the roof hatches. Ensure roof hatches are locked when in the open position. Failure to do so may result in injury to personnel.

There is a sliding weapons hatch (7) in the forward roof behind the driver/operator. The gunner will open the hatch manually with a black handle and unhook the lock latch. Holding the black handle (9) and sliding the hatch backwards until it catches the rear latch and left side lock latch (8) to lock into place, (should hear it click as it locks). To close hatch, gunner will have to reach out on left hand side, grab hold of side lock latch (8) and lift to unlock. Holding the black handle slide the hatch closed until it locks into place with the inside lock latch, (should hear it click as it locks).

(i) Armor Protection

The vehicle provides integral protection for the crew from blast, shock, fragments, and effects of mine blast. It provides crew protection even when a mine is detonated under any wheel or directly under the crew compartment. The vehicle provides crew survivability against antitank mines and small arms fire. Additional protection is provided by the four-point restrain system and shock absorbing seats.

The base cab is constructed of metal-composite materials made of ceramic cylinders-based armor.

The armor system integrates an external armor module to the base armor equipped with internal high-performance liners.

The panel are bolted together and sealed.

The armored windows are bolted on, fixed transparent material and do not open.

Do not allow armor to come into contact with extreme heat such as welding equipment or a cutting torch. Extreme heat will degrade the capability of the armor. Failure to comply will result in damage to equipment.

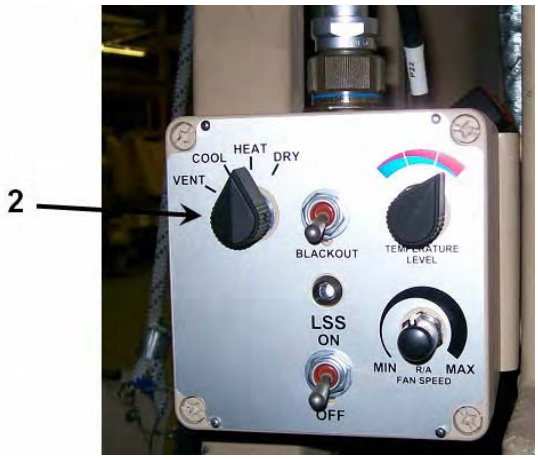
(j) I.R. System

The vehicle has night vision capabilities utilizing infrared (I.R.) technology (1). The I.R. light is located on the left front bumper of the vehicle. The toggle switch on the left will turn the I.R. system on (HIGH), off, and ADJ (adjust). The switch on the right Low and HIGH is for the intensity of the I.R. system. When the toggle switch is in the ADJ position, the control switch can be adjusted between HIGH or LOW intensity, located on the main instrument panel.

(k) Diesel Heater

The vehicle is equipped with a diesel heater (1) located on the frame rail behind the passenger side rear stowage compartment. The diesel heater assists during cold weather starting by heating the engine coolant to 176°F and warming the fuel for the engine. Warm air is also provided for the interior of the vehicle.

(l) HVAC/Life Support System (LSS)

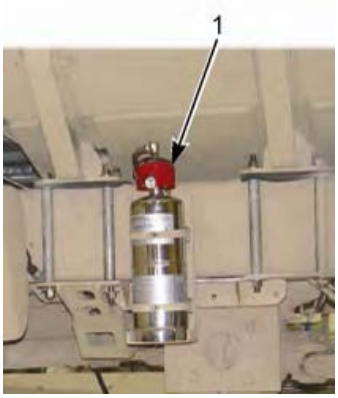


1. The Life Support System (LSS) (1) integrated within the vehicle's overpressure system provides a safe and comfortable indoor air supply for cabin occupants. The LSS unit has the following functions:

- Cabin pressurization with fresh air
- Nuclear, Biologic, and Chemical (NBC) protection
- Space air-conditioning
- Ventilation
- Dust and particulate removal

2. The LSS control unit is mounted behind the front passenger seat. The controls (2) are accessible by the driver and by cabin occupants.

(m) Fire Suppression System (FSS)



1. The Category II vehicle has up to five separate dispersion locations on the Fire Suppression Systems (FSS) (1) that protects the engine, tires, body, fuel, and interior against fire. The CAT I vehicle has engine, tires, fuel and interior capabilities.

The system includes:

- heat detector for the engine
- heat detector for the interior
- dispersion system
- fire suppression units
- dispersion nozzles

WARNING

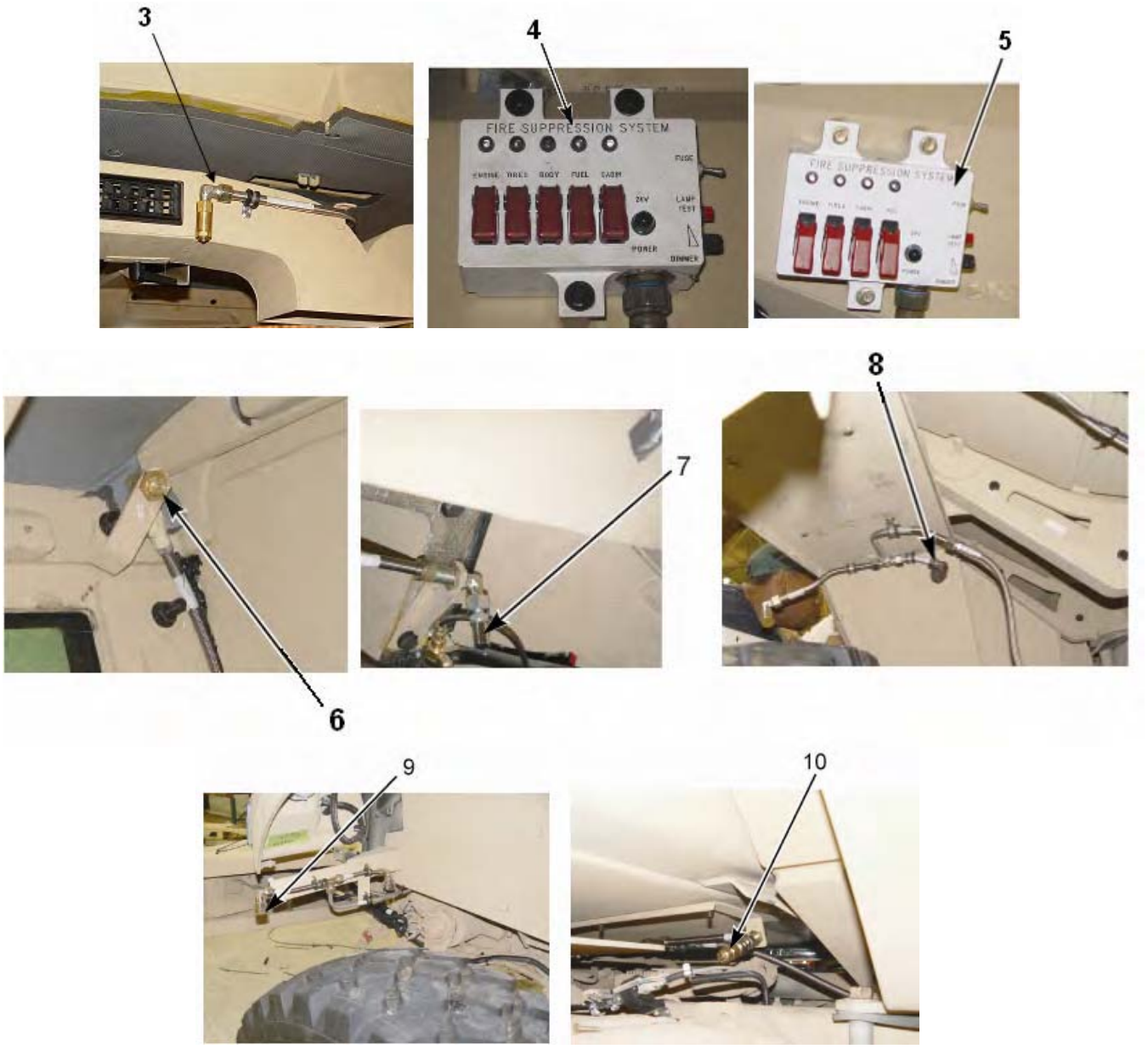
Discharging large quantities of dry chemical fire extinguisher in cab may result in temporary breathing difficulty during and immediately after the discharge event. If at all possible, discharge fire extinguisher from outside the cab. Ventilate and wash cab thoroughly prior to reentry. If respiratory irritation or distress occurs, remove victim to fresh air. Seek medical attention if irritation persists.

Eyes: Flush with cold water for no less than 15 minutes and seek medical attention immediately.

Skin: Flush with large amounts of cold water until all acid is removed. Seek medical attention as required.

Internal: If victim is conscious and alert, give two to three glasses of water to drink and DO NOT induce vomiting. DO NOT leave victim unattended. To prevent aspiration of swallowed product, lay victim on side with head lower than waist. If vomiting occurs and the victim is conscious, give water to further dilute the chemical. Seek medical attention immediately.

2. The engine system and the interior system include an automatic detector that will operate the fire suppression system when fire is detected by the detector.



3. When a fire is present in one of the protected areas : engine (7), front tires (8), rear tires (9), interior (3) and (6), body or fuel tank (10), lift up the cover of the switch and lift the toggle switch CAT I (5), and CAT II (4) up to operate the needed system (for example, if a fire has been detected in the engine, lift up the cover of the engine system switch, and lift the toggle switch up to operate the system).

The Fire Suppression Control Panel has several features:

- indication light for each one of the systems
- manual operation switches for each one of the systems
- automatic fuse
- lamp test
- dimmer
- power light (24V)

4. FSS Bottles

The Fire Suppression System protects personnel from fire.

The fire suppression unit for the crew cabin system is located under the HVAC/LSS.

The fire suppression unit for the engine is located on the right side of the vehicle behind the fans of the air conditioner.

The fire suppression unit for the body is located above the right rear wing of the right rear wheel.

The fire suppression unit for the fuel tank is located on the left side behind the fans of the air conditioner.

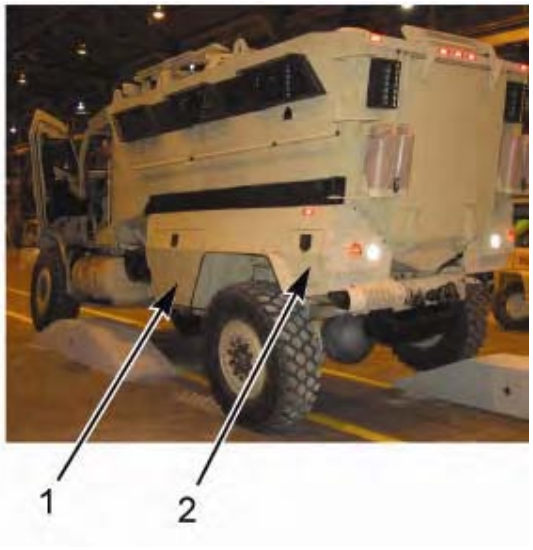
The fire suppression unit for the tires is located on the left rear wing of the left rear wheel.

(n) Spotlight

The vehicle is equipped with a remote controlled spotlight (1) mounted of the driver's side roof. The light is controlled by a wireless remote and/or a dash mounted control. This gives the operator a full 360^{o} horizontal rotation and a 135^{o} vertical tilt (2) with fingertip control.

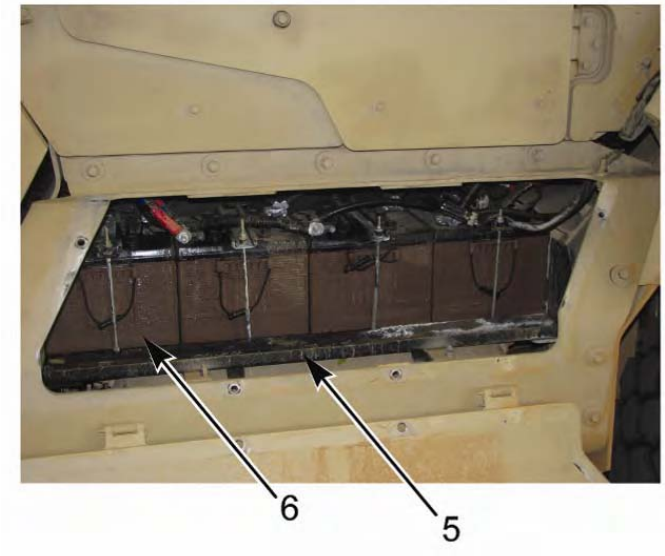
1-7. Exterior Mounted Features

(a) Stowage Boxes



There are four main stowage compartments on this vehicle. Two located in rear (2) and (3) of the vehicle on both left and right sides near the rear wheels and two on front (1) and (4) of the vehicle on both left and right sides just behind the driver and passenger front doors. When you first receive the vehicle, the BII will be stored in the front passenger stowage box (4). Items for each stowage unit will be determined by local load plans.

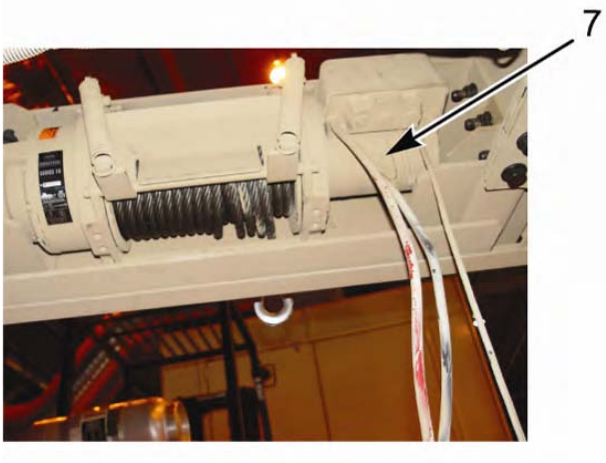
(b) Battery Box



The battery box (5) is located under the passenger side of the cab and stores four 12V batteries (6) connected in series-parallel for 24V system.

(c) Winch System

The vehicle has a front-mounted, deployable self-recovery winch system (7) that is used for self-recovery operations.



The Winch Accessory Kit contains the following items:

Tow Hooks: Secure properly to your vehicle's frame. Tow hooks provide an attachment point for wire rope, straps, and chains.

Clevis/D-Shackles: The D-Shackle is a safe means for connecting the looped ends of cables, straps, and snatch blocks.

Snatch Block: Used properly, the multipurpose 24,000 lb (10,886 kg) snatch block allows you to increase your winch's pulling power and to change your pulling direction without damaging the wire rope.

Choker Chain: Can be used to hook-up to another vehicle or sharp objects for an anchor point.

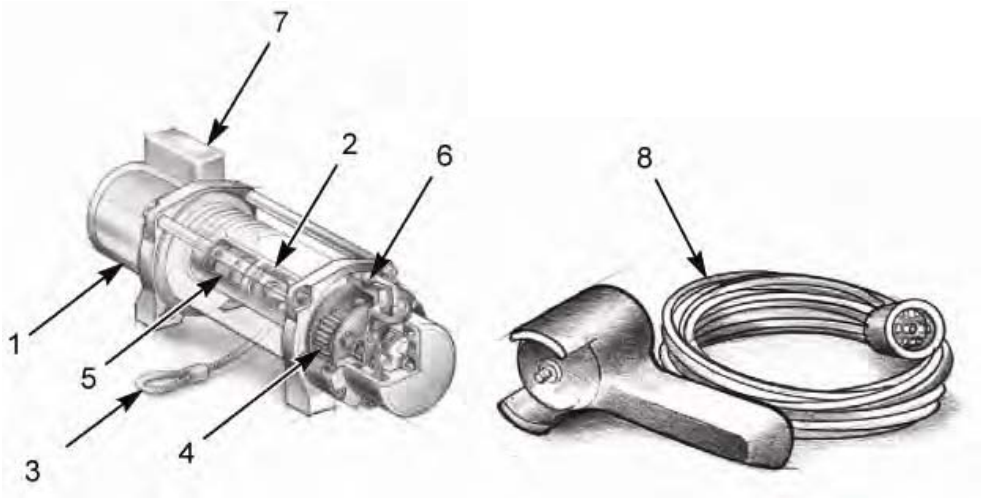
Gloves: Wire rope, through use, will develop "barbs" which can slice skin.

Recovery Straps: Used to "snatch" or pull out a stuck vehicle.

Tree Truck Protector: Use this with a clevis/d-shackle to secure the wire rope to an anchor.

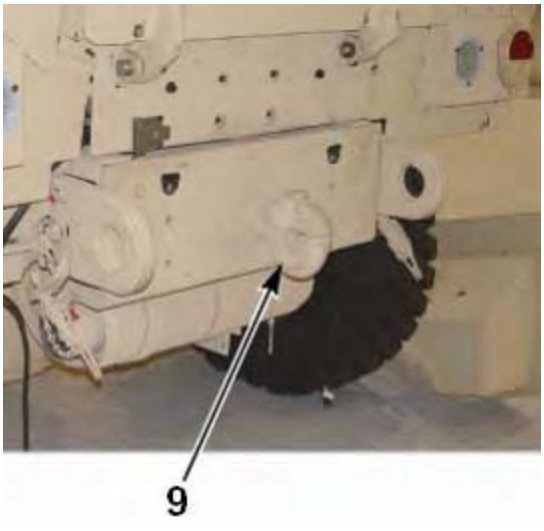
Cable/hook assembly: Wound on a spool motor.

Pulleys: To maintain proper alignment of the winch cable during pay-in and pay-out.



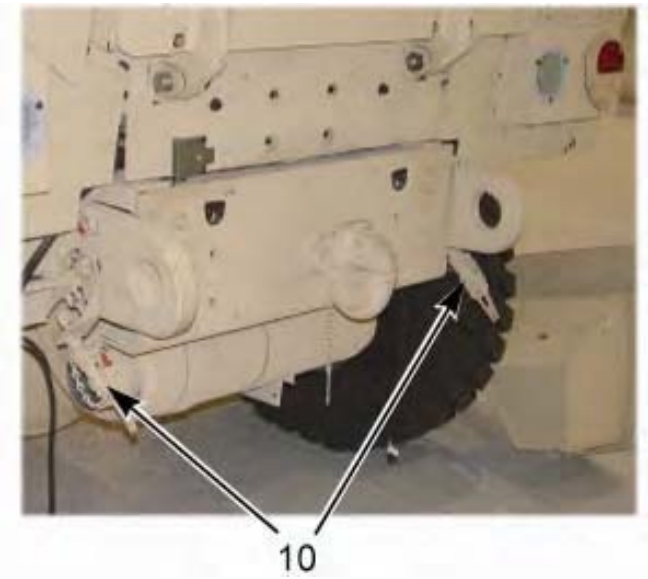
Description of Winch Components and their Functions		
Item #	**Part**	**Description**
1	**Motor**	Typically the winch motor is powered by the vehicle's battery. The motor provides power to the gear mechanism, which turns the winch drum and winds the wire rope
2	**Winch Drum**	The winch drum is the cylinder onto which the wire rope feeds. The drum is driven by the motor and drive train. Its direction can be changed using the remote control.
3	**Wire Rope**	Only use the wire rope assigned for this vehicle. The wire rope is looped at the end to accept the hook's clevis pin and wraps around the winch drum and fed through the fairlead.
4	**Gear Train**	The reduction gear converts the winch motor power into a larger pulling force. The gear train design makes it possible for the winch to be lighter and more compact.
5	**Braking System**	The brake is automatically applied to the winch drum when the winch motor is stopped and there is load on the wire rope. The brake prevents the winch from paying out line, which in turn holds the vehicle in place.
6	**Clutch**	The clutch allows the operator to manually disengage the spooling drum from the gear train, enabling the drum to rotate freely (known as "free-spooling"). Engaging the clutch "locks" the winch drum back onto the gear train.
7	**Control Box**	Using electrical power from the vehicle's battery, the control box solenoids switch power to the motor, enabling the operator to change the direction of the winch drum rotation.
8	**Remote Control**	The remote control plugs into the winch control box, allowing the operator to control the winch direction, as well as stand well clear of the wire rope while operating the winch.

(d) Pintle



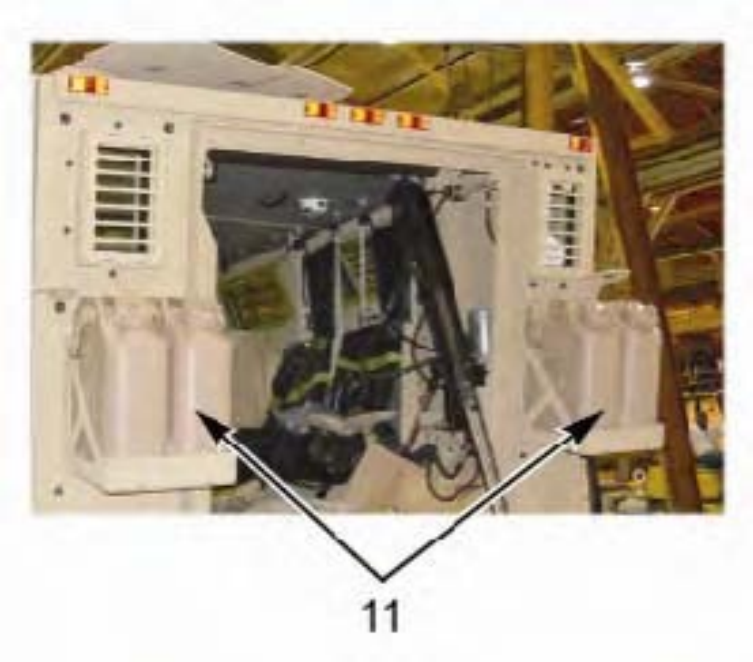
The vehicle is equipped with a rear mounted, swivel pintle (9). The pintle has the capacity to support recovered towing of a like vehicle at GVW. The pintle hooks are used for attaching trailers and tow bars.

(e) Glandhands



Air lines (10) are located on the front and rear crossmember. The two air lines are service brake and park air supplies.

(f) Water Cans and Fuel Cans



The vehicle has two brackets that hold two 5 gallon water or fuel cans (11) each. They are mounted on either side of the rear door/ramp exit. The words FUEL or WATER are molded into the can for identification.

(g) 110V Power Receptacle, NATO Slave Receptacle and Auxiliary Service Air

If the batteries on the vehicle run down and the vehicle will not start, you may want to use another vehicle to provide power to start the vehicle.

The NATO slave receptacle (12) is located in the right front stowage box.

The auxiliary service air fitting (13) is located in the right front stowage box.

There is a 110V receptacle (14) located in the right rear exterior stowage box for use with auxiliary equipment.

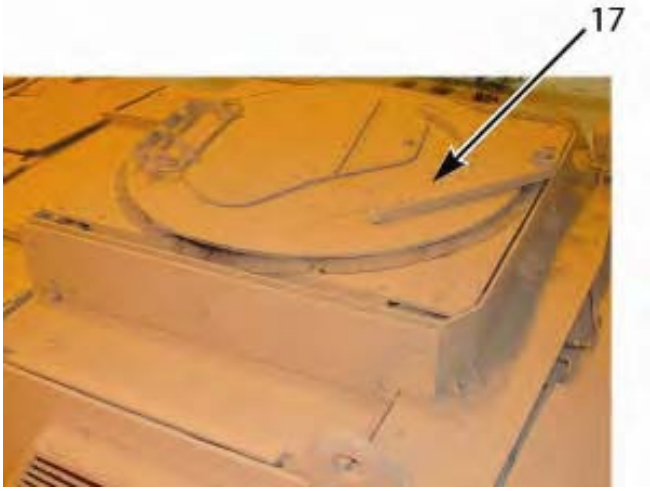
(h) Air Tank Drains

The air tanks (15) are located under the passenger side of the cab beneath the battery box. There are Primary (rear brake) and Secondary (front brake) air system storage tanks.

(i) Fuel Tank

The fuel tank (16) is located under the driver's door of the cab. It stores 70 gallons of fuel to operate vehicle.

(j) Weapons Mount



The weapons mount (17) is located over center of cab roof. The ring mount can rotate for a 360° field of fire.

(k) Engine Hood

The vehicle has a forward opening engine hood (18) with latches on both sides of the cowl.

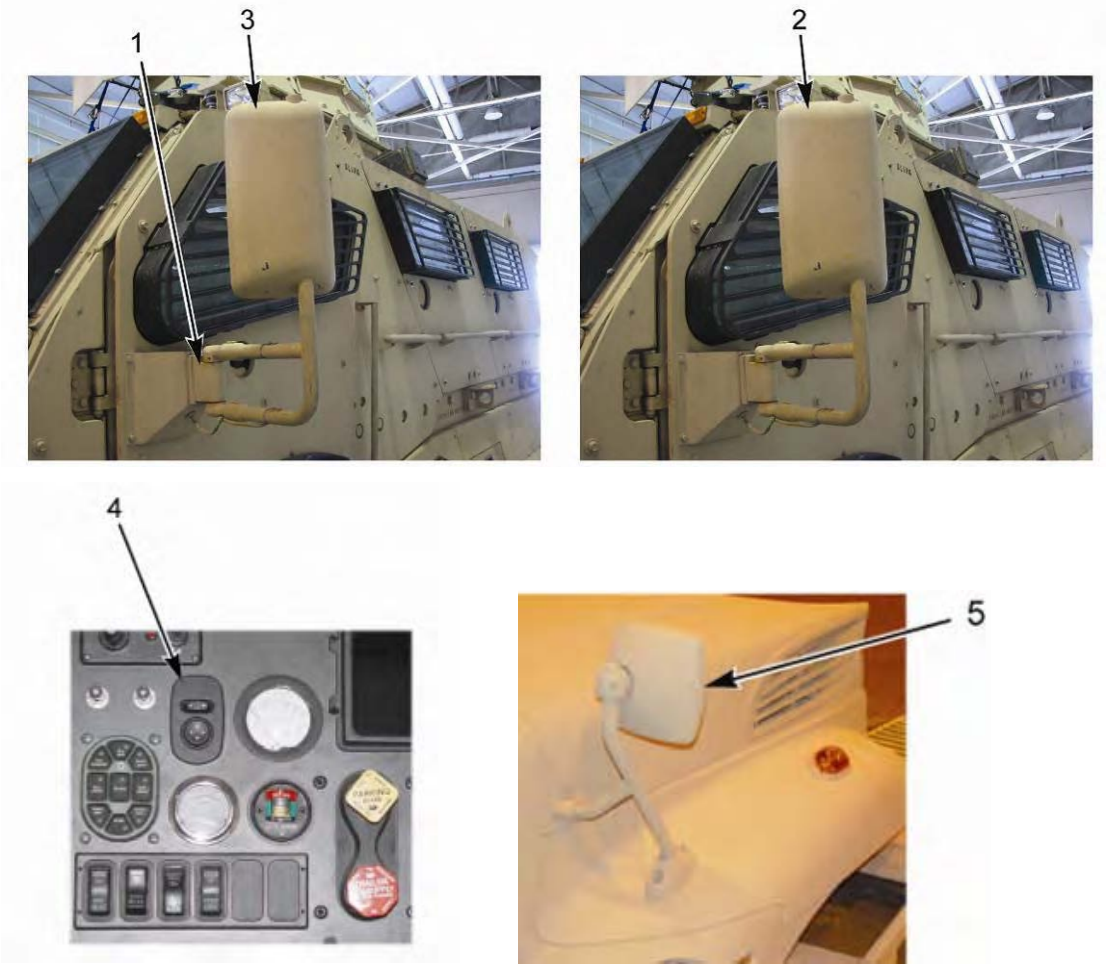
WARNING

Before opening the hood, make sure that there is enough room in front of the vehicle for the hood to open completely without pinning or pinching yourself or an assistant between the hood and any other structure. Failure to comply may result in serious injury or death.

(l) Mirrors

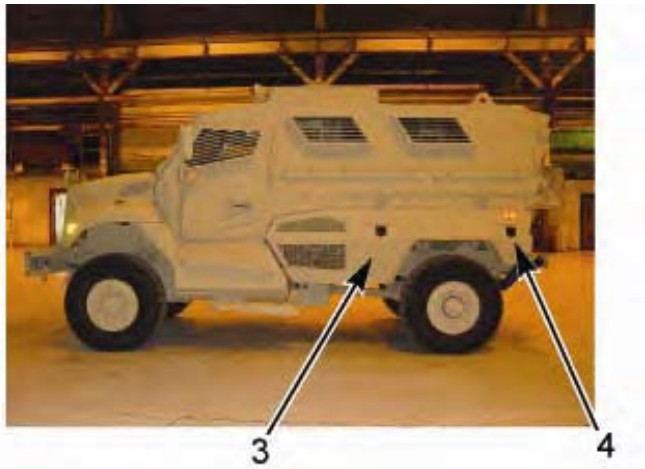
Exterior Mounted Controls and Indicators Table

Key	Control or Indicator	Function
1	Mirror Mount (Both Sides)	Holds mirror in place.
2	Side View Mirror (Both Sides)	Remote controlled allowing operator full range of view of traffic and terrain to rear to vehicle.
3	Side View Spotter Mirror (Both Sides)	Allows viewing of blind spots along side and lower section of vehicle.
4	Mirror Controls	Allows driver to move side view mirrors for better viewing.
5	Fender Mounted Mirror	Allows the driver a wider view of blind spots along sides and rear of vehicle.

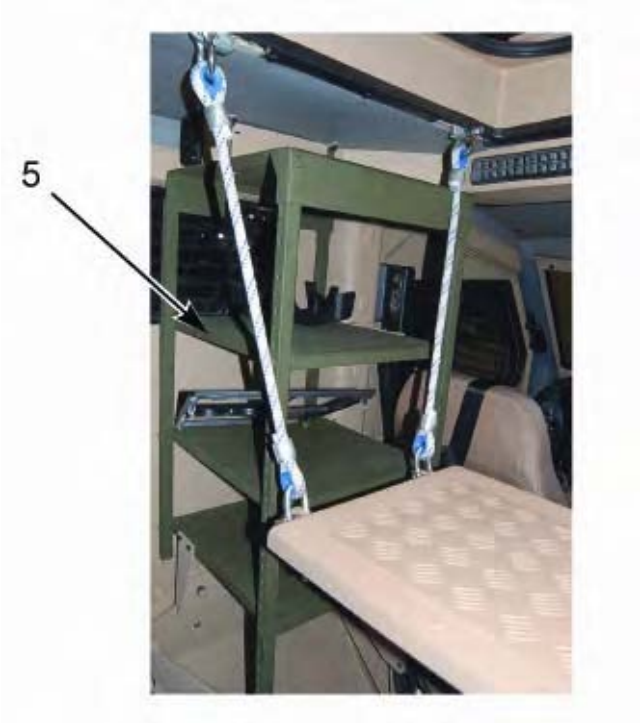


1-8. Transporting Cargo and Mounting Auxiliary Equipment

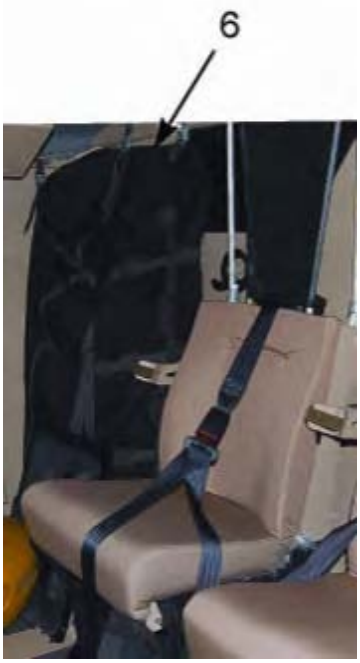
The vehicle provides areas for transporting cargo and mounting auxiliary equipment. Depending on what is to be transported, seats may have to be removed to provide the room. Notify Field Maintenance to remove seats.



- There are four external stowage boxes located on the vehicle. Two located just in front of the rear wheels behind the cab doors (1) and (3), and two located just behind the rear wheels (2) and (4).



- There is a communications rack (5) located behind the drivers seat. This rack may be used for mounting electronics or communications equipment.



- There is a storage cargo bag (6) located behind the left rear crew seat.

- Tie downs (7) and (8) in the crew compartment may also be used to secure larger cargo. Some seats may need to be removed to facilitate for the larger cargo.

Chapter 2 – OPERATOR INSTRUCTIONS

2-1. Operating Under Usual Conditions

(a) Preparation for Operation

The driver is responsible for the safety of personnel riding in their vehicle. Drivers will refuse to move a vehicle if anyone is in an unsafe position or the vehicle has too many passengers. Passenger load for Category I vehicles is 6 persons, and Category II is 10 persons. Ensure all personnel are clear of vehicle before engine start is attempted. Operator/driver must visually check to make sure all areas of vehicle are clear of personnel prior to attempting to start engine. Always use seat belts/shoulder harnesses when vehicle is in operation. Ensure driver side and passenger side mirrors are adjusted to allow for full range of vision prior to operating vehicle. Failure to comply may result in serious injury or death to personnel

The driver's field of view is limited. Ground guides must be used when operating in congested areas or when operating in reverse. Ground guides must stand clear of the vehicle and remain within view of the driver. Failure to comply may result in injury or death to personnel and damage to equipment. The vehicle has a high center of gravity. Slow down for turns and other maneuvers. Approach slopes head on and avoid side slopes when possible. Failure to comply may result in injury or death to personnel and damage to equipment.

Do not attempt to ford water deeper than 36 inches. Ensure bottom surface under water is hard. Reduce speed during fording. Ensure brakes are dry and operating correctly upon completion of fording operation before commencing normal driving. Failure to comply may result in injury to personnel or damage to equipment.

Carbon monoxide is a colorless, odorless, poisonous gas that when breathed deprives the body of oxygen and causes suffocation. The following precautions must be followed to avoid carbon monoxide poisoning. Failure to comply may result in permanent brain damage or death.

Do not operate personnel heater or vehicle engine in an enclosed area without adequate ventilation.

The Auxiliary Diesel Heater must be switched off while any fuel tank on the vehicle is being filled.

Do not idle the vehicle for long periods of time.

Do not sleep in the vehicle with the heater operating or engine idling.

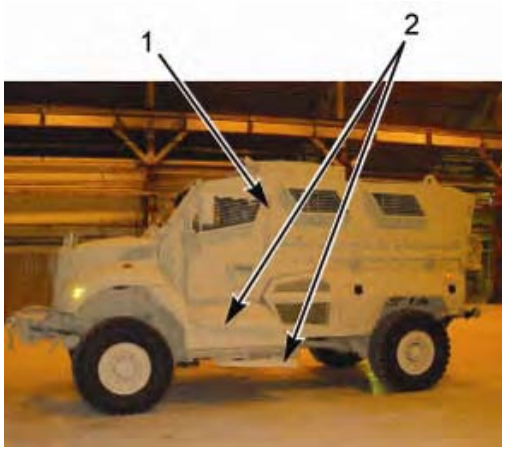
Notify Field Maintenance if exhaust fumes are detected in the crew compartment while operating the vehicle.

Be alert at all times for exhaust odors and symptoms of exposure to carbon monoxide such as headaches, dizziness, loss of muscular control, apparent drowsiness, and coma. If symptoms are evident, move the affected personnel to fresh air, keep them warm, do not permit physical exercise, administer artificial respiration (if necessary), and seek immediate medical attention

(b) Entering the Cab and Adjusting the Operator's Seat

WARNING

DO NOT use steering wheel for hand grip to enter or exit vehicle cab. Use of steering wheel for hand grip may cause sudden violent jerking of vehicle. When entering or exiting cab, use three-point contact system. Failure to comply may result in injury or death to personnel.



1. Enter the cab using the grab handles (1) and the steps (2).

NOTE

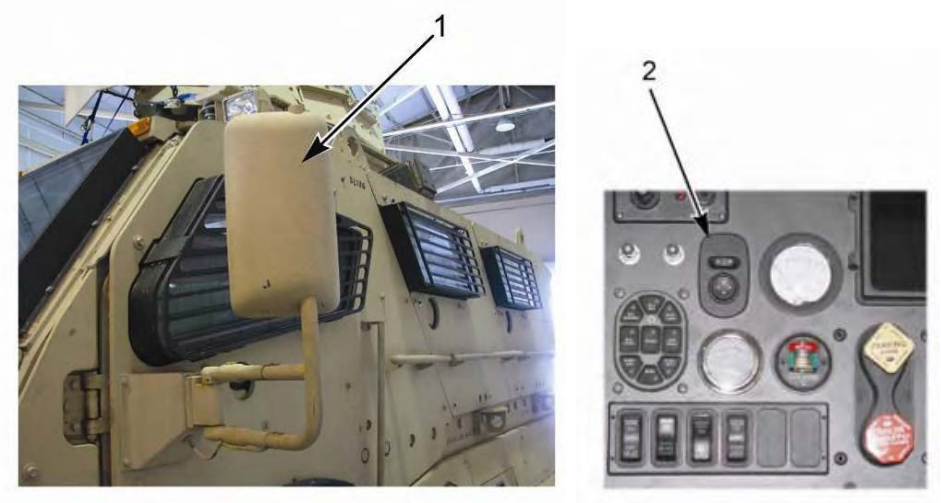
The vehicle operator should be easily able to reach the brake pedal, the throttle control, and the dash controls with the seat adjusted, and the seat belt and shoulder harness on.

(c) Adjusting the Seat

1. Adjust the driver's seat forward or backward by grasping the seat adjustment lever (1) to loosen the seat rail, then sliding the seat backward or forward.
2. Lock the seat into the desired position by releasing the seat adjustment lever.
3. Fasten the seat belts. The driver and each vehicle occupant shall use seat belts when the vehicle is in motion.

(d) Remote Heated Mirror/Heated Windshield Operation

1. To adjust the mirrors use the remove switch located on the center dash panel to adjust the left or right mirror up, down, left, or right. Ensure battery disconnect switch is on.
2. To operate the heat function on the remote mirrors, push the mirror heat rocker switch located on the center dash panel to the on (up) position. To turn the heated mirror rocker switch off, push the rocker switch to the off position (down).



The side mirrors (1) can be remote (2) controlled from inside the cab, allowing the vehicle operator a full range of view for traffic and terrain to the side and the rear of the vehicle. Spotter mirrors on both sides of the vehicle allow viewing of “blind” spots along the side and lower section of the vehicle.

NOTE

The heated mirror rocker switch also operates the heated windshield function at the same time.

(e) Adjusting the Steering Wheel

1. Pull the steering wheel tilt adjustment lever (1) towards the steering wheel to adjust the steering wheel.
2. Release the steering wheel tilt adjustment lever when adjustment is complete.

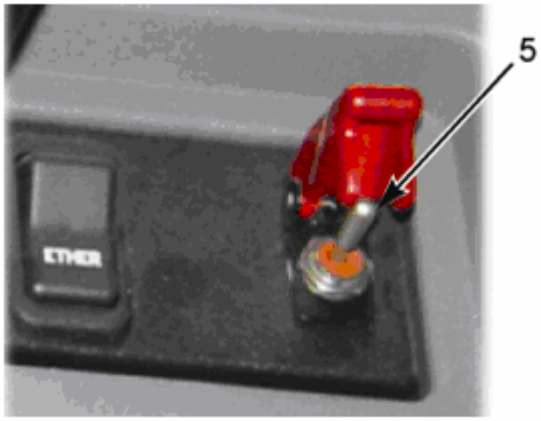
(f) Engine Starting Procedure Above 32°F (0°C)

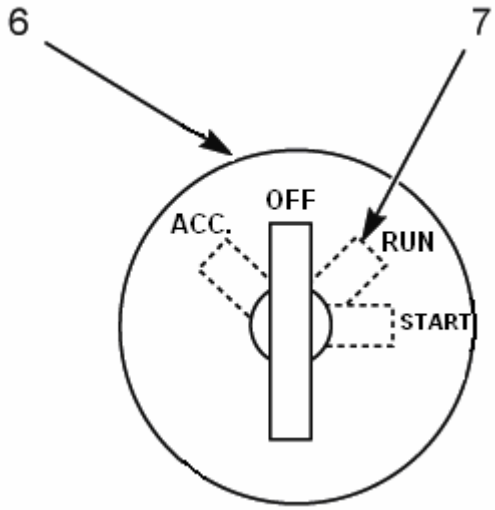
1. Prior to starting the vehicle:
   a. Apply the parking brake (1).
   b. Apply pressure to service brake (2).

2. To start the vehicle:

WARNING

Be alert at all times for the smell of fuel. Hot engines and components can ignite fuel. If fuel smell is detected while operating vehicle, shut down vehicle immediately and notify Field Maintenance. Failure to comply may result in damage to equipment, injury, or death to personnel.





a. Place the Battery Disconnect Switch (5) on the instrument panel in the ON position.

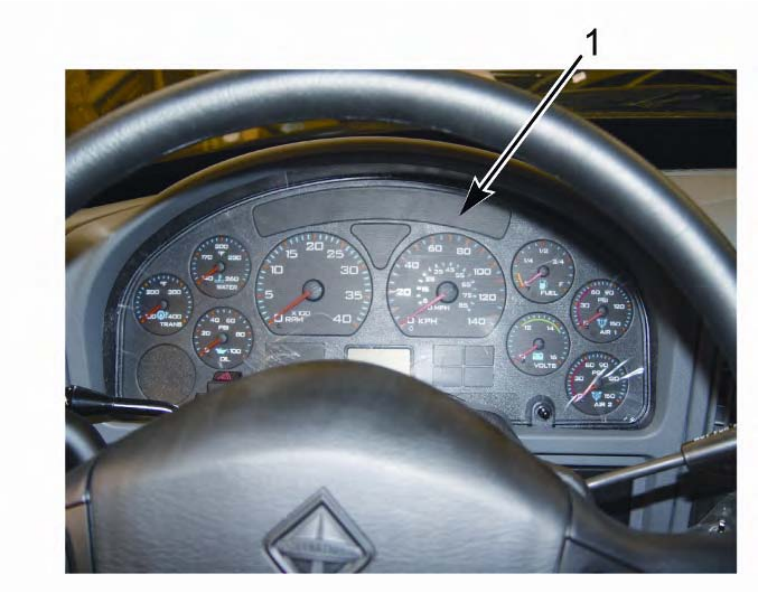
b. Use the ignition switch to start the engine and to turn ON or OFF all vehicle systems.

c. Turn the ignition switch (6) to the START position.

d. When the engine starts, release the ignition switch. The engine will continue to run with the ignition switch in the RUN position (7).

e. To stop the engine, rotate the ignition switch counterclockwise to the vertical OFF position.

(g) Service Brake Operation



1. Check the ABS indicator light (1) when ignition switch is turned ON.
2. Allow air pressure to build during start-up. Idle the engine while watching the indicator gauge.

3. When the gauge has reached safe operating pressure (approximately 70 psi), and the audible tone stops, release brake (2) by pushing yellow button in.

NOTE

If the operating pressure drops below 70 psi, the spring brakes will apply and the vehicle cannot be moved.

4. Place transmission in DRIVE (D), and apply gentle pressure to the gas pedal.

(h) Brake Operation and Use

WARNING

Do not have or apply open flames to air lines or valves. This can cause internal damage to nonmetallic parts of valves and melt or burn non-metallic air lines. This can also result in vehicle fire. Do not pour liquids into air lines or hose couplings; this can cause immediate and severe damage to rubber components, even methanol alcohol. Fluids poured into the system will wash lubricants out of valves and collect in brake chambers and valves. Failure to comply will result in damage to equipment and or serious injury or death to personnel.

1. Set the parking brake (1) and set transmission selector to NEUTRAL (N) (2).
2. Start engine normally and watch air pressure gauges (3) on left hand side of instrument dash panel.
3. When vehicle is first started there will be a warning sound alerting you that air pressure is low and will stop when the air gauges reach a minimum of 60 to 70 psi.
4. The air pressure will raise to normal operating pressure 125 ± 5 psi within 30 to 60 seconds. If it does not, shut vehicle off and investigate the malfunction. If the malfunction cannot be resolved, contact Field Maintenance.
5. Once vehicle is started and air pressure is normal, press the service brake pedal (4) and press transmission selector into DRIVE (D) (6) and proceed.
6. When you need to stop, remove your foot from the throttle (gas) pedal (5) and apply steady pressure to the service brake pedal (4).

(i) ABS Operation and Use

1. This vehicle is equipped with electronic Antilock Braking System (ABS) to help improve braking when excessive wheel slippage or wheel lock-up is detected.
2. When you have to stop suddenly, DO NOT PUMP brake pedal, apply steady pressure.
3. The ABS system will take over and apply extra pressure to the wheel or wheels that need it and you will feel a fast pulsation on the brake pedal. This is normal and not a concern. The ABS system is taking over and stopping the vehicle or slowing it down.

(j) Transmission and Transfer Case Operation and Use

CAUTION

During operation if a check transmission light comes on DO NOT shift the transmission into Neutral. Use transmission emergency operation procedures found in this manual before proceeding.

NOTE

The vehicle's transmission control is located between the front driver and passenger seats. The service brake must be pressed in order to place the transmission into gear.

1. Place foot on the service brake (1).
2. Shift the transmission into REVERSE or DRIVE by pressing either (R) or (D) on the transmission control (2).
3. Release the parking brake (3).
4. Release the service brake (1).
5. When in DRIVE, select a lower range by pressing and releasing the "DOWN" arrow button (4).
6. When in DRIVE, select a higher range by pressing and releasing the "UP" arrow button (5).
7. Place the transmission in NEUTRAL by pressing the (N) button (6).
8. Transfer case can shift to LOW, HIGH, or NEUTRAL (7).

NOTE

Vehicle must be stopped and brake applied to shift the transfer case.

(k) Windshield Wiper/Wash Operation

1. The multi-function turn signal/windshield wiper switch is mounted on the left side of the steering column, below the steering wheel. The electric wiper has two speeds, HIGH and LOW. The wiper also has off/on cycle intervals. The windshield washer is controlled by the WASHER/WIPER knob.

   a. Operate the electric wiper by rotating the WASHER/WIPER knob (1).

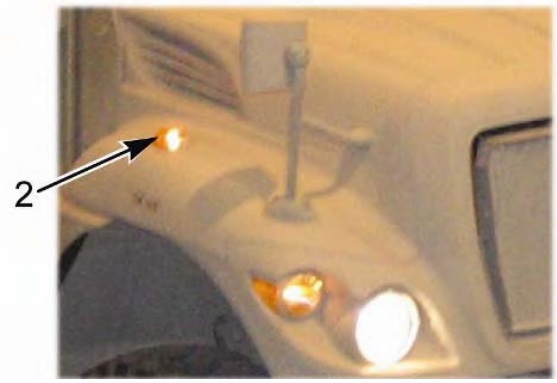
   b. Operate the windshield washer by pushing IN on the wiper knob (2) to spray solution on the windshield. The wipers will start and will continue for two cycles.

(l) Vehicle Lighting

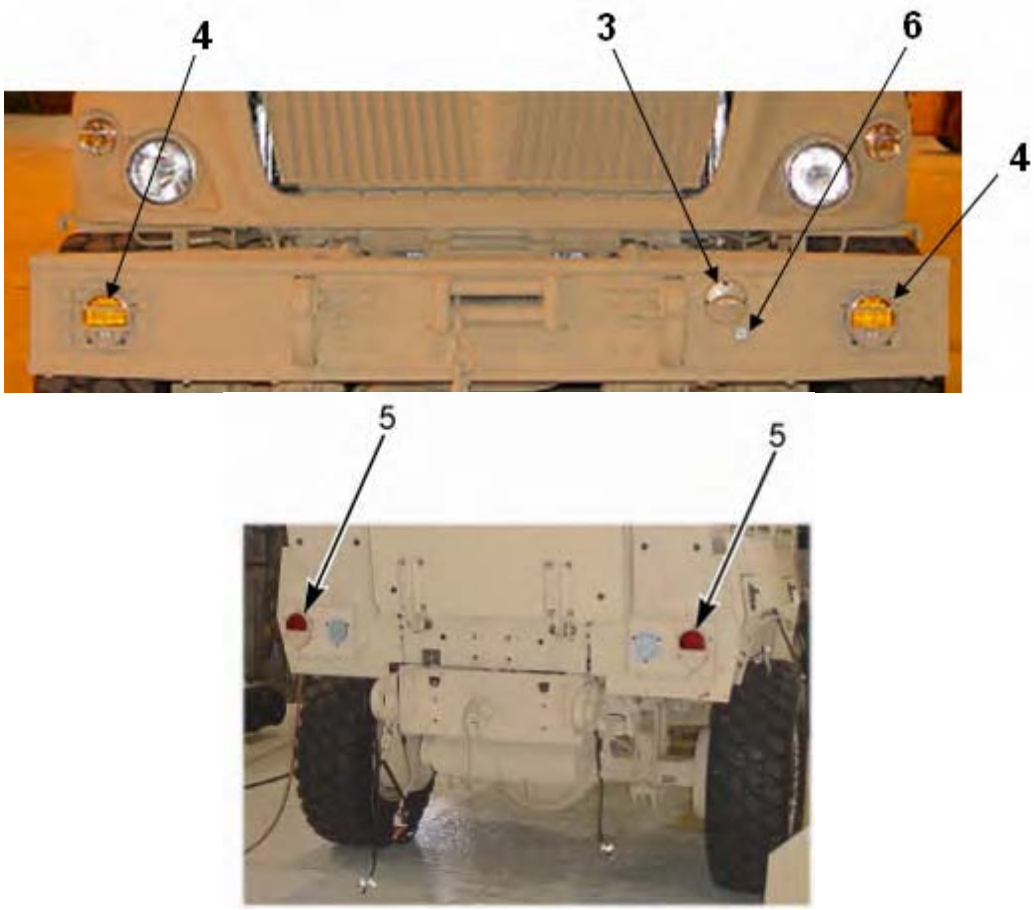
1. Vehicle lights are controlled by a vehicle light control panel (1) on the center instrument panel.

NOTE

Headlight High beam/Low beam Operation: To switch headlights from low beam to high beam pull the turn signal lever towards you. The high beam indicator on the dash panel will illuminate blue. To switch the headlights from high beam to low beam pull the turn signal lever towards you. The high beam indicator on the dash panel will turn off.

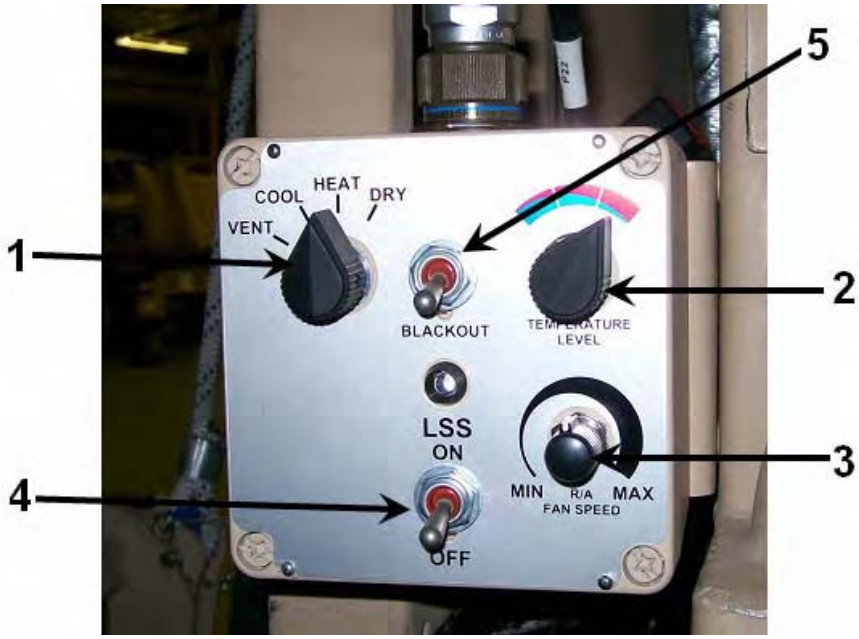


2. Marker lights (2) are located on the vehicle's fenders.



3. Blackout light (3) is located on the left front corner of front bumper. There are four blackout marker lights, two on front bumper (4) and two on the rear (5). They are located on the left and right edges of the vehicle's bumpers.
4. An I.R. lamp (6) is located on the left side of the front bumper.

(m) Heating, Ventilation, and Air-Conditioning Operation (HVAC) Life Support System (LSS)



1. The HVAC/LSS has a fan speed control, a temperature control, and a mode control.
2. The system operates in the following modes:
   a. **Operating Modes Switch (1):** Used to activate or to deactivate the following modes:
      - **DRY Mode:** This is the defrost mode. When using this mode, open the handle above the driver to direct air to the window. Use the Temperature Level to adjust heat setting.
      - **HEAT Mode:** This setting provides Maximum heat to the cab area.
      - **OFF:** Turns OFF fresh and re-circulating air in the cab area.
      - **VENT:** Only fresh air received from the outside enters the cab through the NBC filter (if installed). You cannot adjust the Fan speed.
      - **COOL:** Fresh air and recycled air are mixed and cooled to provide air conditioning.

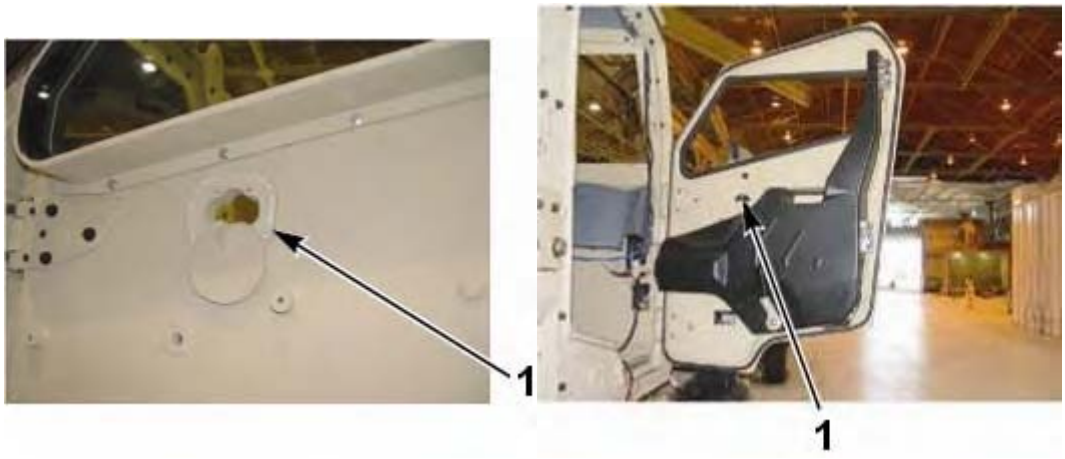
   b. **Temperature Level (2):** Heats or cools the cab air relative to ambient air.

   c. **Fan Speed (3):** Controls the amount of air that is re-circulated within the cab.

   d. **LSS ON/OFF Switch (4):** used to activate or to deactivate the air pressure system. Overpressure is provided on when LSS switch (4) is in the ON position. With overpressure outside contaminants cannot enter the Cab.

   e. **BLACKOUT (5):** Turns LSS Light OFF.

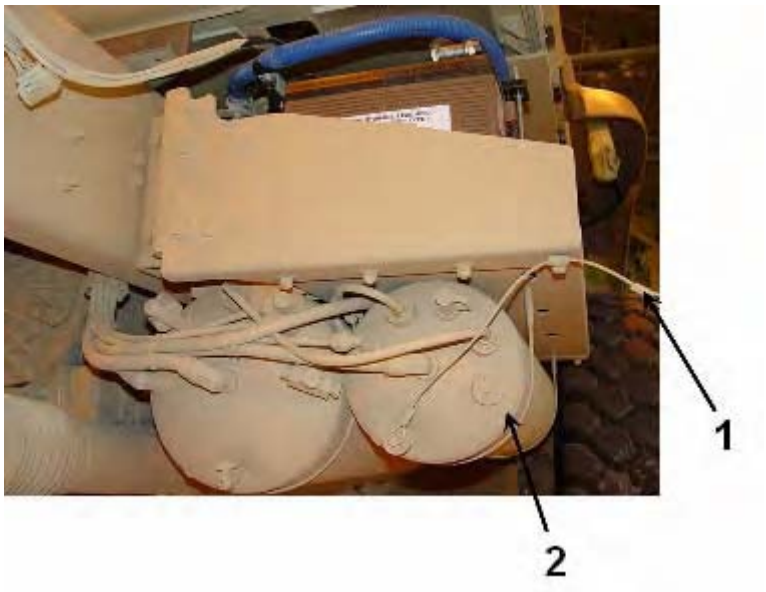
(n) Gun Ports



1. To open the gun ports:
   a. Push the gun port handle outward.
   b. Turn the handle counterclockwise.

2. To close the gun ports:
   a. Pull the gun port handle inward.
   b. Turn the handle clockwise.

(o) Air Tank Drains



1. To drain condensation, pull the cord (1) on the front air tank (2).

(p) All Wheel Drive Operation and Use

1. Where conditions warrant, such as a grade with mud/sand/snow, or fording, it is likely that a four-wheel drive or a lower setting will be needed to complete the required task.
2. If it is known that a certain mode is required to negotiate a given terrain or discrete obstacle, the operator should set the vehicle to that mode before approaching the area. This will minimize damage to the terrain, and minimize the risk of damage to the vehicle and the risk of the vehicle becoming immobilized.

CAUTION

The vehicle cannot be driven in rear wheel or four-wheel drive with the transfer case in the NEUTRAL (N) position. The NEUTRAL (N) position should be used if being towed or for special applications.

The vehicle must be completely stopped with the service brake applied before shifting between rear wheel and four-wheel drive, or to shift range in either mode. Failure to comply may result in damage to equipment.

3. The vehicle's transfer case control is located on the instrument panel between the front driver and passenger seat.

Front Axle Switch (1):

- LED ON – Front axle (four-wheel drive) is engaged
- LED OFF - Rear wheel drive only, front axle disengaged

Three position switch (2):

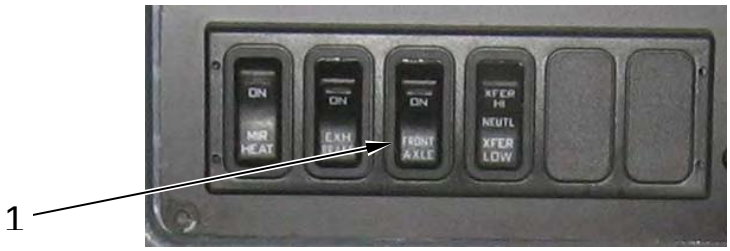
- XFER HI – Places the transfer case in high gear
- NEUTRAL – Can be used for towing or special applications
- XFER LOW – Places the transfer case in low gear

(q) Exhaust Brake Operation and Use

1. Using the exhaust braking features allows the driver to slow the vehicle or to maintain a constant speed on steep road grades that would otherwise result in prolonged use of the service brake that could cause a “brake fade”.

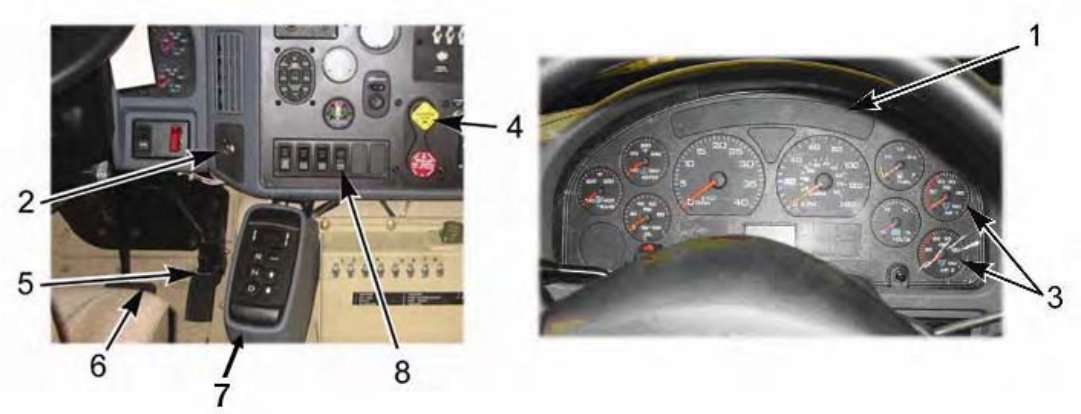
WARNING

The service brakes should always be used as the primary vehicle braking system. The exhaust brake should never be considered a substitute for the vehicle’s service brakes. The exhaust brake cannot bring the vehicle to a complete stop. Only the service brakes can bring the vehicle to a complete stop. Using the exhaust brakes in place of the service brakes may result in death or injury to personnel, or damage to equipment.



2. The EXHAUST BRAKE/ON/OFF switch (1) is located on the Central Control Panel.

(r) Normal Driving Procedures



1. With the vehicle idling, the ABS light should not be on. The ABS light (1) will stay illuminated if there is an ABS error.
2. Check the air pressure gauge (3) during start-up and idle. This vehicle has two air tank pressure gauges on the instrument panel. The low air pressure warning will sound when you start the engine. As air pressure reaches 70 psi in both tanks, the warning sound should stop.

CAUTION

Let air pressure build in both tanks to 100 psi before releasing the parking brake.

3. Apply the service brake (6).
4. Ensure transfer case is in proper gear.
5. Release the parking brake (4).
6. Place transmission in DRIVE (D) or REVERSE (R) (7).

NOTE

Vehicle will not move if transfer case is not in either HIGH or LOW range. Always select HIGH range when starting vehicle.

7. Release the service brake (6).
8. Lightly depress the accelerator (5).

(s) Engine Shutdown

1. Stop the vehicle in a safe area.
2. Apply service brake.
3. Press N to put transmission in NEUTRAL (N).
4. Apply parking brake by pulling yellow knob out.
5. Idle the engine for three to five minutes before shutting down. Idling allows the lubricating oil and water to carry heat away from vehicle components. Also allows turbo charger to slow down and cool.
6. Turn the ignition switch (2) to OFF.
7. Turn the Battery Disconnect Switch to OFF.

(t) Parking Vehicle

1. Stop the vehicle safely off the roadway and away from flammable materials.
2. Apply the parking brake by pulling yellow knob out.
3. When parking on a grade, chock wheels and turn front wheels to keep vehicle from rolling into the traveled portion of the roadway. Wheels should ALWAYS be chocked when vehicle is parked.
4. Idle the engine for three to five minutes before shutting down. Idling allows the lubricating oil and water to carry heat away from vehicle components.
5. Turn OFF ignition switch.
6. Turn OFF Battery Disconnect Switch.

(u) Operation on Steep Grades (Descending Grades)

CAUTION

Always descend hills with extreme care, relying primarily on exhaust braking effect to control the vehicle speed. Heed warning signs posted for any grade. Engine damage may occur if engine is allowed to exceed 2200 rpm.

Never coast downhill. Service brakes alone should not be used to control speed on major downgrades.

1. Prior to descent, stop the vehicle. Control downhill speed by removing your foot from the accelerator pedal (2) and manually selecting a gear (3).
2. Select a lower gear than would be required to ascend the slope.
3. Use the service brakes (1) to assist the engine exhaust brake. When descending long grades that require use of the service brakes, use hard pressure braking with applications of 3 to 5 seconds duration instead of long, continuous applications. This brake application minimizes temperature rise, brake fade, and air consumption by the air brake system, DO NOT drag brakes.

(v) Slippery Conditions

NOTE

Do not rely on the ABS system to interrupt the engine or the exhaust brake on slippery road surfaces. The ABS cannot provide any better braking and steering capability than the available road traction will permit.

NOTE

Stopping on a slippery road will require more distance than stopping on a dry road. Reduce vehicle speed to compensate for the extra time and distance required to stop or slow the vehicle on slippery roads.

1. Begin driving vehicle. DO NOT spin wheels when beginning to move vehicle.
2. Keep throttle control steady after vehicle reaches desired speed.
3. Turn vehicle slowly when on loose or slippery surfaces.
4. When driving over hills, steer vehicle straight up and straight down hills whenever possible.
5. Activate turn signals sooner, to give early warning to following vehicles.
6. Apply service brakes sooner, and press service brake pedal lightly to give early warning to any vehicles that are following you.
7. Allow for additional stopping distance.
8. Keep windshield, windows, mirrors, headlights, stoplights, and marker lights clean and free of mud, snow, and ice. Use defroster, windshield wiper, and washer to keep windshield free of mud, snow, and ice.
9. After driving through slush or water, drive slowly and test service brakes.
10. To dry out brake shoes and drums, lightly press and hold service brake pedal 5 to 10 seconds at a time, while lightly applying throttle. This will cause a slight drag to dry the brakeshoes. You should only have to do this 2 to 3 times to dry brakes.

(w) Spot Light Operation

1. To operate the spotlight place the toggle switch located on the center dash panel to the on position (up).
2. Use the control knob to rotate the spot light in the desired direction.

(x) Night Vision Operation

1. To operate the Night Vision function
    a. Remove the protective cap from the night vision connection port (1).
    b. Connect the night vision device to the night vision connection port (1) located on the center dash panel.
    c. Place the night vision toggle switch (2) in the on position (up).
2. To disable the night vision function
    a. Place the night vision toggle switch (2) in the off passion (down).
    b. Remove the connection of the night vision device from the night vision connection port (1).
    c. Replace protective cap on the night vision connection port.

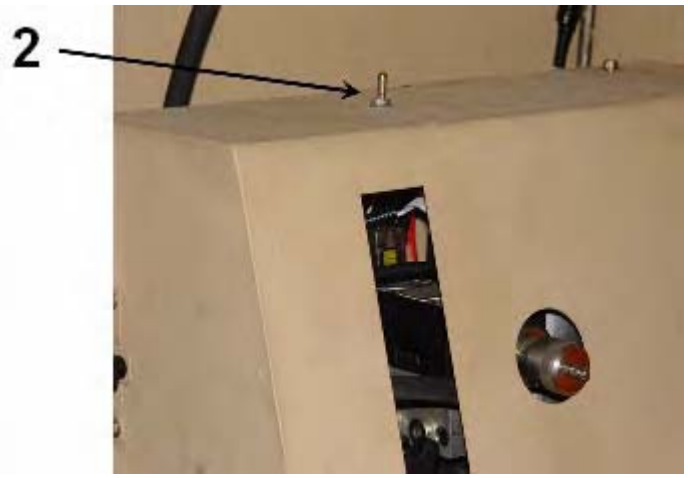
(y) Ramp Operations

NOTE

The ramp can be operated electrically, manually, or using the hydraulics.

1. To operate the ramp electrically from the cab compartment use the ramp toggle switch (1) located on the center dash panel. Pace the toggle switch in the down position to lower the ramp. Place the toggle switch in the up position to raise the ramp.

2. To operate the ramp electrically from the crew compartment use the ramp toggle switch (2) located on the hydraulic pump reservoir cover. Place the toggle switch in the down position to lower the ramp. Place the toggle switch in the up position to raise the ramp.



3. To operate the ramp using the hydraulic pump located in the crew compartment push the round plunger (3) in and turn plunger clockwise, insert the handle (4) into the pump and move the handle back and forth to lower the ramp. To raise the ramp, turn the round plunger (3) counter clockwise and push the plunger out, insert the handle (4) into the pump and move the handle back and forth to raise the ramp.

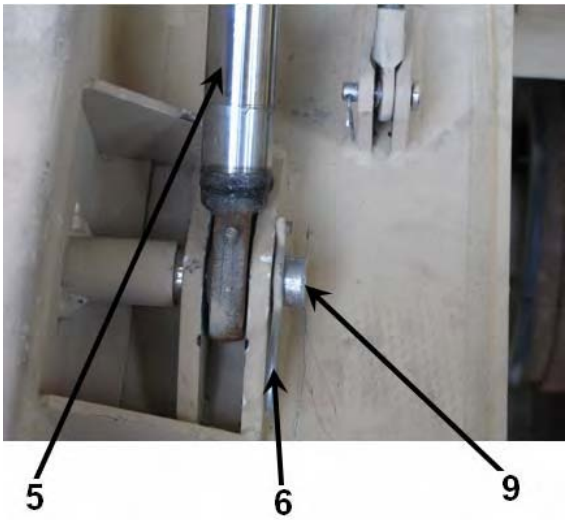
WARNING

Ensure (by looking out one of the small rear windows) that no one is behind the vehicle when lowering the rear door/ramp. DO NOT operate the rear door/ramp when vehicle is in motion. Use extreme caution when using the emergency rear door/ramp release that no one can be struck by the door as it falls open. Sound horn before lowering door/ramp. Keep arms and legs clear of rear door/ramp when closing it. Failure to comply may result in serious injury or death to personnel.

NOTE

This operation is used in emergency situations when no other means can open the ramp.

4. To operate the ramp manually, remove the safety pin (5) from the lower connection point of the main cylinder (6). Using the pump handle (7) place it in the hole on the center bar (8) and rotate the center bar to unlock the ramp. Remove the pin (9) in the lower connection point of the main hydraulic cylinder to allow the ramp to fall open.



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2-2. OPERATING UNDER UNUSUAL CONDITIONS

(a) Extreme Heat and/or Dust

When operating vehicle in temperatures above 100°F (38°C), extra care must be taken to prevent overheating the engine if temperature is over 230°F (110°C) and transmission temperature over 250°F (120°C). Observe water and transmission oil temperature gauges closely. Failure to comply may result in damage to equipment.

Check fluid levels often in extreme heat. Vehicle cooling and lubrication systems support each other. Failure to comply may cause failure of other systems, and will cause damage to equipment.

Temperatures may change as much as 70°F (21°C) between day and night. Due to expansion and contraction of all fluids, care should be taken when filling fuel tank and fluid reservoirs to prevent overflow when temperatures change, (e.g. filling tank full of cold fuel may cause fuel tank to overflow when fuel expands as fuel heats up). Failure to comply may result in damage to equipment.

Overheating of engine or transmission has occurred if:

- Engine coolant temperature is at or above 230°F (110°C) as indicated by water temperature gauge.
- Engine oil pressure drops below normal operating range (40psi – 70 psi).
- Transmission oil temperature is at or above 250°F (120°C), as indicated by transmission oil temperature gauge.

The engine oil pressure has three monitoring systems: low oil pressure light, check engine light, and oil pressure gauge. If any two of the three systems indicate a problem, park the vehicle, shut down the engine, and notify Field Maintenance. If only one system indicates a problem and the other two are operating normally, proceed with your mission and notify maintenance upon completion.

The engine coolant temperature has three monitoring systems: water temperature light, check engine light, and water temperature gauge. If any two of the three indicate a problem, park the vehicle and allow engine to idle until water temperature cools down. If water temperature does not go down, shut engine OFF and notify Field Maintenance.

Above normal coolant temperature can accrue while driving in a transmission gear ratio, which would lug the engine. To correct this, engine speed should be increased by shifting into the next lower gear to increase engine rpm's, which will increase coolant flow through the radiator.

1. Check all fluids and oil levels often.
2. Check air filter restriction indicator frequently. If indicator shows RED and stays there, replace the filter.
3. If water temperature gauge indicates coolant temperature is above 220°, perform the following steps:
   a. Downshift to next lower gear range, slow vehicle, and continue operation.
   b. When water temperature gauge reads normal, upshift to normal gear range and continue operation.
   c. If water temperature gauge does not return to normal, stop vehicle, place transmission selector in NEUTRAL (N), set parking brake and allow engine to cool by letting engine idle at 700 rpm for 3 to 5 minutes.

d. When water temperature gauge returns to normal, shift to normal gear range and continue operation.

4. If temperature continues to increase, shut OFF engine and refer to Troubleshooting section.
5. Allow engine to cool before re-filling fuel tank to prevent condensation. Keep the external surface of the engine, radiator, AC condenser and accessories clean to avoid dirt build up or damage.
6. Inspect the radiator, AC condenser, and accessories for dirt buildup or damage.

(b) Extended Idling

In cold conditions, if after 5 minutes of idle time and the intake air temperature is below 32°F (0°C), the CAP system will slowly ramp up the engine idle speed. The engine idle speed will automatically increase or decrease in rpm (because of software in the ECM) to maintain a coolant temperature between 149°F (65°C) and 160°F (71°C).

(c) Mud, Sand, or Snow

NOTE

Driving in mud can degrade vehicle braking and speed up brake shoe wear. If braking degrades while operating in mud, clean brakes by driving vehicle approximately 500 ft (153 m) with brakes applied. This must be done with brake drums totally out of mud so the drying action can take place. If braking is not restored by drying brakes, notify Field Maintenance.

1. Check air filter restrictions indicator often. Moisture and dirt in the filter elements will plug the filters and cause engine damage.

NOTE

For better traction, keep speeds low and operate in low 4 x 4 range.

2. Set transmission shifter to appropriate position. Manually select SECOND or THIRD gear to avoid wheel spin.
3. Begin driving vehicle. Start out slow, DO NOT spin wheels when beginning to move vehicle.
4. Keep throttle control steady after vehicle reaches a desired speed.
5. Turn vehicle slowly when on loose or slippery surfaces. Turning too fast could cause vehicle to get stuck.
6. When driving over hills, steer vehicle straight up and down hills whenever possible. Driving up on an angle could tip the vehicle over.
7. Activate turn signals sooner than required, to give early warning to following vehicles.
8. Give early warning to following vehicles. Apply service brakes sooner by lightly pressing brake pedal. This will give early warning to the following vehicles that you will be slowing or stopping, and to allow for additional stopping distance.
9. Keep windshield, windows, mirrors, headlights, stoplights, and marker lights clean and free of mud, snow, and ice. Use defroster, windshield wipers, and washer fluid to keep windshield free of mud, snow, and ice.

10. After driving through slush or water, drive slowly and test service brakes. If vehicle does not slow down normally, perform the following:
    a. Turn hazard flashers on until you have brake control.
    b. Continue to drive slowly.
    c. To dry out brake shoes and drums, lightly press and hold service brake pedal 5 to 10 seconds at a time, while lightly applying throttle, (this will cause a slight drag to dry the brake shoes). You should only have to do this 2 to 3 times to dry brakes.
    d. Resume appropriate driving speed.
11. If vehicle skids or vehicle starts to slide, perform the following:
    a. Let up slowly on throttle control.
    b. Steer vehicle in direction of skid or slide and slowly apply service brake pedal until vehicle stops.
    c. Do not over steer during these conditions. Over steering will cause loss of control of the vehicle.
12. Park vehicle as follows:

Operator must take every precaution to prevent snow from blowing into engine when parked. Snow will melt and later form ice to jam engine controls.

a. Park vehicle so vehicle does not face into the wind if possible.
b. Apply service brake and place transmission selector into NEUTRAL, (N).
c. Shut off engine, chock wheels, and clean mud off vehicle body.

DO NOT direct high-pressure water stream at seals, air intake, exhaust outlet, radiator, condenser, or other components of vehicle that could be easily damaged by high-pressure water stream. Failure to comply may result in damage to equipment.

d. Clean mud from wheels, brakes, axles, universal joints, steering mechanism, transmission, and transfer case oil coolers, filters assemblies, hoses as soon as possible.

2-3. COLD WEATHER OPERATIONS

(a) Cold Weather Starting (below 32°F)(0°C)

The driver is responsible for the safety of personnel riding in their vehicle. Drivers will refuse to move a vehicle if anyone is in an unsafe position or the vehicle has too many passengers. Passenger load for Category I vehicles is 6 persons, and Category II is 10 persons. Ensure all personnel are clear of vehicle before engine start is attempted. Operator/driver must visually check to make sure all areas of vehicle are clear of personnel prior to attempting to start engine. Always use seat belts/shoulder harnesses when vehicle is in operation. Ensure driver side and passenger side mirrors are adjusted to allow for full range of vision prior to operating vehicle. Failure to comply may result in serious injury or death to personnel.

DO NOT increase the engine speed, until the oil pressure gauge is in the normal range 15 to 40 psi (103-276 kPa). To avoid damage to engine and related components, shut engine off if oil pressure is not registered within 20 to 30 seconds on dash oil pressure gauge. Failure to comply may result in damage to equipment.

If engine fails to start within two minutes, turn ignition switch to off position. Allow starter to cool for at least 2 to 3 minutes before trying again. DO NOT turn ignition switch to START position while engine is rotating. The fuel/water separator filter should be drained of all water before topping off fuel tank. During cold weather operations keep fuel tank as full as possible. This will keep water from forming and freezing in the fuel lines. If engine fails to start in cold environment after five attempts, refer to Troubleshooting. Failure to comply may result in damage to equipment.

NOTE

This is an Electronic Controlled Engine. When the engine is idling in cold weather, the engine may automatically increase its idle rpm, to maintain a safe engine operating temperature. Increase in idle rpm in cold weather is normal and should not concern the operator.

1. Turn Battery Disconnect Switch (1) to the ON position.

NOTE

Do not depress the accelerator pedal (2).

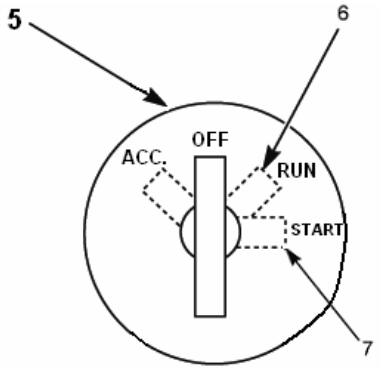
2. Set parking brake (3) and make sure that transmission is in NEUTRAL (N) (4).
3. Adjust operator seat. Adjust both driver door and passenger door outside mirrors.
4. Turn DEFROST lever behind driver's seat and above driver side (ceiling of vehicle) to ON position. Turn HVAC to DRY mode, and FAN to appropriate setting.
5. Push the ether start button for 2 to 3 seconds to manually inject ether into the engine whenever the ignition is turned to the start position in temperatures below 32°F (0°C).

6. Turn the ignition switch (5) clockwise (to the right) to the Run position (6). This position should be held for at least 20 seconds before starting vehicle. This allows the ether start system to cycle and provide ether to engine air intake manifold.

CAUTION

To avoid engine damage, if engine fails to start within 30 seconds, release ignition switch and wait 2 to 3 minutes to allow starter motor to cool. If three attempts are made to start engine and engine still fails to start, investigate and determine the cause for the NO START condition. If continued attempts are tried damage to the starter motor will occur.

7. Turn ignition switch to START position (7) for not more than 30 seconds or until engine starts. Release switch as soon as engine starts.
8. If engine fails to start easily, the ignition switch MUST be turned to OFF position. This must be accomplished prior to the next start attempt. This disengages the engine restart interlock, which prevents the starter engagement from the ON position.



(b) Operating Vehicle in Cold Weather (below 32°F)(0°C)

CAUTION

In cold weather, do not start driving right away after it has started. Not only does the engine have to warm-up, but also the cooling system and transmission. The transmission will only operate in NEUTRAL (N), REVERSE (R), and THIRD (T) gears when it is below a temperature of 19°F (-7°C). Above 19°F (-7°C) the transmission will operate in all ranges. Failure to comply may result in damage to equipment.

In cold weather, if oil pressure gauge does not show appropriate oil pressure reading within 10 to 15 seconds after starting engine, shut down immediately and refer to Troubleshooting Symptoms. Lack of lubrication may damage engine. Ensure oil pressure gauge reads safe range during idle and increase as engine speed increases. Failure to comply may result in damage to equipment.

1. After cold weather starting, check that oil pressure gauge (8) reads safe range during idle and increases as engine speed increases.
2. Run engine until it idles smoothly, and then increase engine speed to 1200 to 1500 rpm for another 25 minutes.

CAUTION

DO NOT use first gear to move vehicle if tires are frozen to the ground or if brakes are frozen to drums. Failure to comply may result in damage to driveline.

Start vehicle out in SECOND or THIRD gear if tires or brakes are frozen. The movement of the wheels will heat the tires and brakes to thaw them.

3. Set transmission shifter to THIRD (T) by manually selecting the gear, release parking brake, and slowly drive vehicle 3 to 5 miles to warm up the driveline components, tires, and brakes.

4. When operating in mud/sand/snow conditions, see Operating Vehicle Under Unusual Conditions -Mud, Sand, or Snow.
5. When operating in slippery conditions, see Operating Vehicle Under Normal Conditions – Slippery Conditions.
6. Park vehicle as follows:

    a. Park vehicle in a sheltered area if possible out of the wind or so that it does not face the wind if no shelter is available.

Operator must take every precaution to prevent snow from blowing into engine when parked. Snow will melt and later form ice to jam engine controls.

    b. Park on high, dry ground if possible or spread out planks or brush to make raised or dry area so tires will not freeze to the ground in snow, water, ice, or mud.

    c. Park vehicle on level ground so the body does not twist.

7. Shut engine OFF as follows:

The engine must be kept running until the engine coolant temperature reaches a minimum of 160°F (71°C) prior to shutting the engine OFF. Drain water from fuel/water separator after shutdown. Depending on environmental conditions, it could take up to 45 minutes for coolant temperatures to reach 160°F (71°C). Failure to comply may result in damage to equipment.

    a. Press down on service brake.

    b. Set transmission selector to NEUTRAL (N).

    c. Once you start the engine, do not turn engine OFF until coolant temperature reaches 160°F (71°C).

    d. Let engine return to normal idle.

    e. Turn ignition switch to OFF position.

    f. Turn Battery Disconnect Switch to OFF position.

    g. Drain water from fuel/water separator after shutdown.

(c) Auxiliary Diesel Heater

The vehicle is equipped with a diesel heater located behind the passenger side rear stowage compartment. Once the engine is started, it uses the engine coolant to heat the engine block and provide heat to the interior of the vehicle. The auxiliary diesel heater (1) is controlled by switches on the control panel of the HVAC/LSS system.

WARNING

Do not operate personnel heater or vehicle engine in an enclosed area without adequate ventilation.

The Auxiliary Diesel Heater must be switched off while any fuel tank on the vehicle is being filled.

NOTE

If the heater fails to start the first time it will automatically attempt a second start. If unsuccessful, the heater will shut down completely.

NOTE

On initial start up the heater may require several start attempts to self prime the fuel system.

1. To operate the heater place the HVAC/LSS control switch in the heat position. Once switched to the heat position the following sequence occurs:
   a. Control unit does a systems check (flame sensor, glow pin, motors, temperature sensor, safety thermal sensor and various other control unit checks).
   b. Water pump starts circulating coolant fluid.
   c. Combustion air blower comes on.
   d. Glow pin begins to preheat 20-50 seconds.

e. Once ignition takes place the flame sensor alerts the control unit and the control unit shuts off the glow pin (ignition tm: 1.5 – 2 minutes).

2. Once ignition is successful the following operations take place:

   a. Heater runs in high heat mode and the temperature is monitored at the heat exchanger.

   b. Once coolant reaches 176 F (80 C) the heater automatically switches to low heat mode and continues to run.

   c. If coolant temperature drops to 167 F (75 C) the heater will automatically switch back to high heat mode.

   d. If the coolant temperature continues to rise, the heater will automatically switch off once temperature reaches 187 F (86 C).

   e. The water pump will continue to circulate coolant to allow the heater to monitor engine temperature.

   f. The heater will automatically re-start once coolant temperature reaches 167 F (75 C).

   g. The heater continues to run as described above until it is switched off, either manually, automatically by a timer or heat malfunction shutdown.

NOTE

If the heater should shut down due to flame out while in running mode, it will automatically attempt one restart. If successful, it will continue to run, if not successful, it will shut down completely with a cool-down cycle.

NOTE

During operation the heater continually senses the input voltage from the batteries. If the input voltage drops to approximately 10.5 volts or rises above 16 volts the heater will automatically shut down with a cool-down cycle, and display a fault code when using a multifunction timer.

2-4. FORD WATER OBSTACLE

(a) General

Do not Ford Water unless the depth is known, 36 in. (92 cm) including wave height. If engine stops, immediately attempt to restart engine. If the engine will not re-start, have vehicle towed or use winch to pull vehicle from water with another vehicle as soon as possible. Failure to comply may result in damage to equipment.

1. Ensure depth of fording site is not more than 36 in. (91.5 cm).
2. Ensure bottom of fording site is firm enough so that 36 in. (91.5 cm) maximum fording depth will not be exceeded and vehicle will not become mired.
3. Stop vehicle at edge of water, if conditions permit.

Ensure brake drums are cool before entering water. Failure to comply may result in damage to equipment.

4. If brakes have been heavily used or are hot, allow drums and shoes to cool before entering water if the conditions permit.
5. You should always approach water slowly, drive vehicle through water as slowly as possible to avoid making waves.
6. Select FIRST (F) gear on the transmission selector and LOW range on the transfer case. Enter the water slowly and with caution.

If engine stops, immediately attempt to restart engine. If the engine will not re-start, have vehicle towed or use winch to pull vehicle from water with another vehicle as soon as possible. Failure to comply may result in damage to equipment.

7. Unless absolutely necessary, DO NOT stop while driving in the water.
8. If vehicle accidentally enters water deeper than 36 in. (91.52 cm), perform the following:
   a. Press and hold service brake pedal to stop vehicle.
   b. Set transmission selector to REVERSE (R).
   c. Let up on service brake pedal.
   d. Press down lightly on throttle control and slowly back vehicle out of water.
   e. Once out of water far enough, turn vehicle around, stop and select DRIVE (D) on transmission selector.

9. To dry out brake shoes and drums, lightly press and hold service brake pedal 5 to 10 seconds at a time, while lightly applying throttle, (this will cause a slight drag to dry the brake shoes). You should only have to do this 2 to 3 times to dry brakes.
10. When clear of fording area, stop vehicle.
11. If water entered the interior of the vehicle, remove the drain plugs and allow the water to drain out. Reinstall the drain plugs after the water is gone.
12. If vehicle came in contact with salt water, wash vehicle with fresh water to minimize possible corrosion as soon as possible.
13. Set transmission selector to appropriate gear and continue mission.
14. Remove water and clean deposits from all areas of vehicle as soon as possible.

2-5. OPERATING UNDER EMERGENCY CONDITIONS

(a) Transmission Emergency Operation Procedures (Limp Home)

If CHECK TRANS light comes on when vehicle is operating, apply service brakes and stop vehicle. DO NOT shift into NEUTRAL (N), and perform the following Transmission Emergency Operation Procedures (Limp Home):

Transmission Limp Home Procedure

Select REVERSE (R) on transmission range selector and note if vehicle transmission shifts.

If transmission shifts into REVERSE (R), set transmission range selector to appropriate position DRIVE (D) and continue with mission. Notify Field Maintenance when the mission is complete.

If transmission does not shift into REVERSE (R), transmission may be locked into a specific gear and may not come out of gear, even if engine is turned OFF. The operator must be aware that once the engine is turned OFF and NEUTRAL (N) cannot be selected, vehicle is inoperable and the mission cannot be completed until the problem is corrected.

(b) Slave Starting

If the batteries on the vehicle have run down and they will not start the vehicle, use another vehicle to provide the power to start the vehicle.

NOTE

Always use the slave receptacle when performing this operation.

1. The slave receptacle (1) on this vehicle is located on the right front passenger side stowage box on the forward side of box towards top.
2. Have vehicles close enough to open the stowage boxes while still able to move safely between the two vehicles.

3. Turn OFF ignition on both vehicles. Unplug unnecessary accessories. Turn OFF lights, radio, or anything else as not to cause a spark while connecting slave cable to both vehicles.
4. Locate the slave receptacles on both vehicles, and remove the caps.
5. Connect the slave cable to the disabled vehicle.
6. Connect slave cable to the slaving unit vehicle.
7. Start the slaving unit vehicle.

NOTE

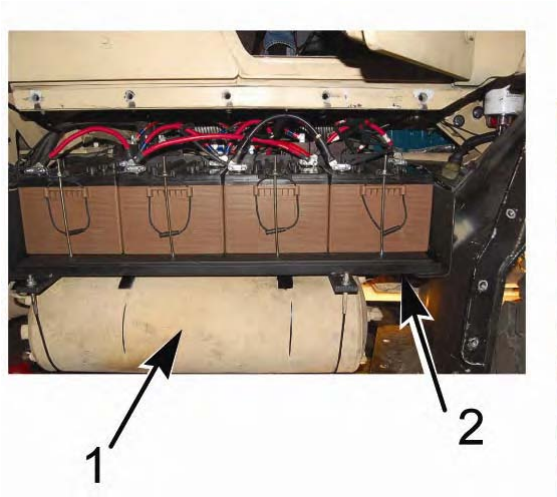
Once slaving unit is started with cable connected, let slave unit run to charge battery before attempting to start vehicle.

8. The operator of the slaving unit vehicle must run the engine at 1000 rpm or higher before the disabled vehicle can attempt to start. This will start the charging of the batteries.
9. Once the disabled vehicle has started and is running smoothly, disconnect the slave cable from both vehicles, and re-install caps.

After vehicle batteries have been slave started, the alternator needs to have time to start charging. If accessories in the vehicle or the vehicle itself are used before a sufficient amount of charge is in the batteries, the alternator can overcharge them. Failure to comply will result in equipment damage.

10. Allow the disabled vehicle, now running, to run and charge for at least 10 minutes before using vehicle or accessories. This can make the alternator over charge the batteries and damage them.

(b) Loss of Air System Pressure



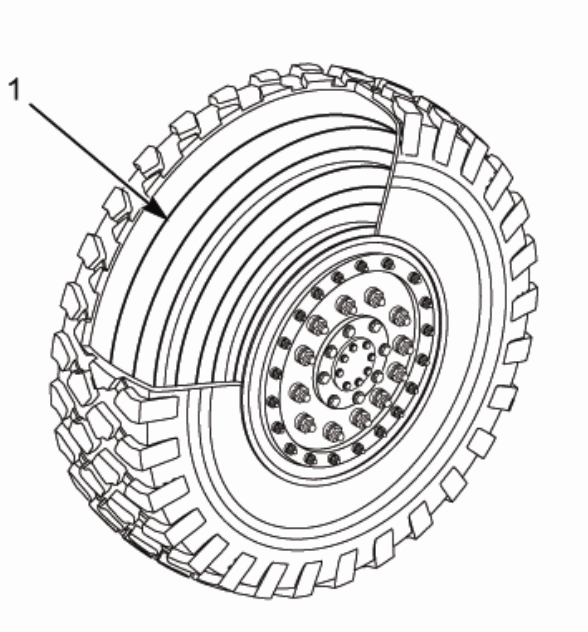
1. Vehicle is equipped with two air tanks (1) located on the passenger right side of vehicle, under the battery box (2). There are also two dash mounted gauges (3) to monitor the air pressure. The normal operating pressure on the air gauges is 125 ± 5 psi. Spring brakes will come on at 69 psi. When the air pressure gauges indicates a significant loss of air pressure, 40-45 psi or more, slow down and remove vehicle from road at first appropriate location.
2. The vehicle is equipped also with a low air pressure warning sound and BRAKE PRESSURE warning light on dash panel. This warning sound and light will activate when either section of the split air brake system is reduced to 70 psi. Vehicle needs to be removed from the road as quickly and safely as possible as spring brakes will engage at 69 psi. The warning sound and light will go off when vehicle engine is shut OFF. It will continue to come back on when restarted unless air system pressure issue has been resolved and repaired.

(c) Engine Out of Fuel, Restart Procedures

CAUTION

Contact Field Maintenance to perform restart procedure when vehicle is completely out of fuel. This procedure is not to be performed by the crew. Failure to comply may result in damage to equipment.

(d) Run Flat Operations



Run Flat Tires

The vehicle is equipped with run flat tires (1). If the tires lose air you can still operate the vehicle at a speed no greater than 35 mph for up to 30 miles. The purpose of a run flat system (1) is to allow escape capability for a vehicle experiencing one or more deflated or damaged tires to continue on its mission for some extended distance.

Run Flat Tires will:

- Increase the mobility of the vehicle when it needs to transit soft ground such as sand, mud, swamp, and snow.
- Lock the bead of the tire against the side of the rim to avoid tire slippage.
- Prevent tire separation, provide airtight seal, and prevent foreign objects from entering the tire.
- Reduce the impact of mine fragments on the vehicle driver and crew.
- Reduce pressure values considerably on the driver cabin following a mine detonation.
- Redirect the typical blast from land mines in the manner that would normally destroy a vehicle and severely injure crewmembers. Redirect blast laterally where far less damage to vehicle and crew will occur.

(e) Winch Operations

This section explains the basic on how to operate the winch. There are many WARNING's and CAUTION's for this device and they MUST be followed.

To avoid injury to hands or fingers, always keep hands clear of wire rope, hook loop, hook and fairlead opening during installation, operation, and when spooling in or out. Always wear heavy leather gloves when handling a wire rope. Always remove all jewelry to avoid being caught in wire rope and wear eye protection. Never let a wire rope slip through your hands. Always be aware of possible hot surface at winch motor, drum, or wire rope during or after winch use. Always use extreme caution when handling hook and wire rope during spooling operations. Always use supplied hook strap whenever spooling wire rope in or out, during installation or operation to avoid injury to hands or fingers.

Never use as a hoist, or to suspend a load. Never use to lift or move persons. Failure to observe these instructions could lead to serve injury or death to personnel.

Failure to observe these instructions could result in injury to personnel. Always inspect winch installation and wire rope before operating winch. Frayed, kinked, or damaged wire rope must be replaced immediately. Loose or damaged winch installation must be corrected immediately.

Never winch with less than five wraps of wire around the drum, the wire rope could come loose from the drum. Never touch wire rope or hook while in tension or under load. Never touch wire rope or hook while someone else is at the control switch or during winching operation. Never touch wire rope or hook while remote control is plugged into winch. Never exceed winch or wire rope rated capacity. Never engage or disengage clutch if winch is under load, wire rope is in tension, or wire rope drum is moving.

Always stand clear of wire rope and load and keep others away while winching. Always require operator and by standers to be aware of stability during winching of vehicle and/or load. Always keep remote control lead clear of the drum, wire rope, and rigging. Inspect for cracks, pinches, frayed wires, or loose connections. Replace if damaged.

Never leave remote control plugged into winch while free spooling, rigging, or sitting idle. Never hook wire rope back onto itself. This damages the wire rope. Always use a choker chain, wire choker rope or tree trunk protector on the anchor.

Always prior to winching, remove any objects that may interfere with the safe winch operation. Always be certain the anchor you select will withstand the load.

NOTE

Always avoid continuous side pulls that can pile up wire rope at one end of the drum. This can damage your wire rope or winch. Always ensure the clutch is fully engaged or disengaged.

Never use winch to tow other vehicles. Never "jog" wire rope under load. Shock loads can momentarily exceed capacity of wire rope and winch. Never use winch to secure a load during transport. Never submerge winch in water.

Always store remote control in the designated stowage space.

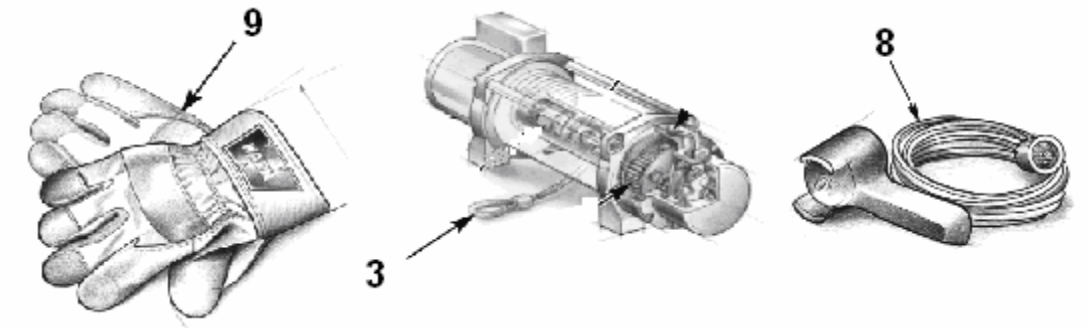
1. General

   The winch is controlled by the hand held remote control (8) switches to allow the operator to stand clear during the winching operation. Prolonged use of the winch without cooling will damage the motor. In addition, if the engine is idling during winching, the battery may drain faster than it is charging. Pay close attention to voltage gauge to make sure you don't drain the battery's too low to start your vehicle.

2. Before You Pull

   a. Always take your time to assess your problem and plan your pull carefully.

   b. Always take your time when using a winch.



   c. Use the proper equipment for each situation.

   d. Always wear leather gloves (9) and do not allow the wire rope (3) to slide through bare hands.

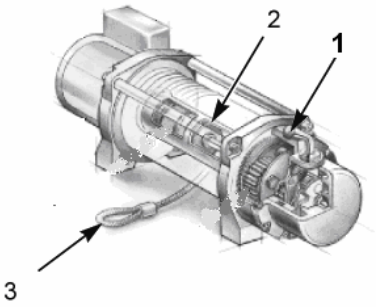
   e. Only one or two persons should handle the wire rope (3) and remote control switch (8).

   f. Think safety at all times.

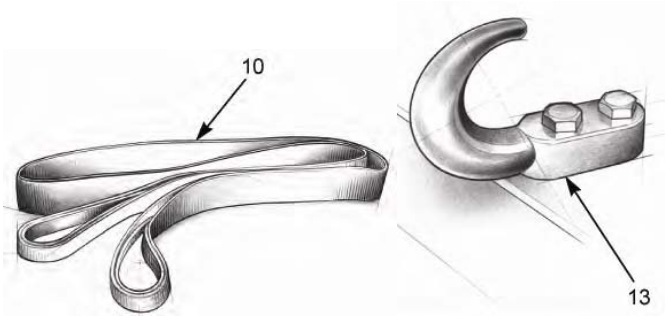
3. Rigging for Pull

Do not use winch cable if it shows any signs of damage – crushed, frayed, broken, or corroded strands of the cable can result in catastrophic failure. Failure to comply may result in damage to equipment or serious injury or death to personnel.

   a. Put on GLOVES.



b. Disengage CLUTCH (1). Rotate the clutch lever (1) on the winch to allow free-spooling of the winch drum (2) to conserve battery power. If not able to pull manually, pay-out with remote control.

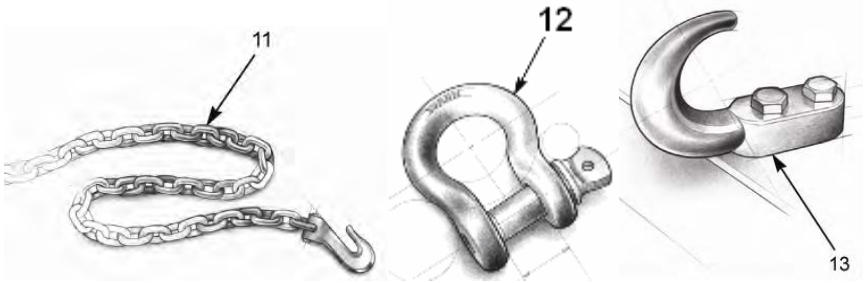


c. Free the winch hook (13) from its anchor point and attach strap (10) to hook (13) for pulling wire rope (3).

WARNING

If recovery strap is used for anything other than to snatch or pull out a stuck vehicle, the strap can break, causing serious equipment damage or serious injury or death to personnel.

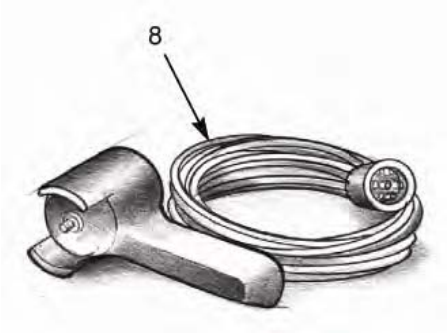
d. Pull out or pay-out enough wire rope (3) to reach your target area. Be sure to keep enough tension in the wire rope (3) as to prevent it from twisting or overlapping when slackened which can lead to wire rope (3) damage.



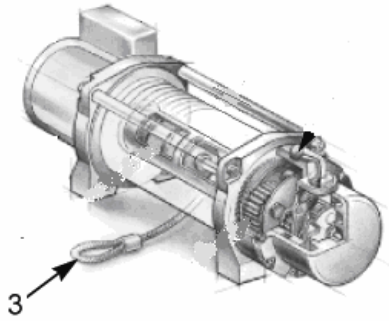
e. Remove strap, established your anchor point and secure proper connection to it with chocker chain (11), shackle (12), hook (13), or other means to pull.

f. Attach proper equipment needed for job.

g. Lock the clutch (1) if it was disengages to pull.



h. Connect the remote control (8) and be careful not to let the cord dangle anywhere near the front of the winch. Always disconnect remote (8) when not in use.



i. Put wire rope (3) under tension slowly using the switch on remote (8). This will lessen the change of damage to the wire rope (3) due to kink or bind and you can make sure that no object gets in the pathway of the cable. Stand clear of wire rope (3) and never step over it.

j. Make sure all connections are secure and free of debris.

k. Check the wire rope (3) as it is winding around the drum spool (2). Improper winding can cause damage to the wire rope (3).

l. Mark sure that everyone around you is aware of and knows what you are about to do. Make sure no-one is in your blind spot (where you can not see).

m. You may begin winching with the vehicle's engine on and light tension on the wire rope (3). Slowly and steadily begin winching; be sure wire rope (3) is winding evenly and tightly around drum spool (2).

NOTE

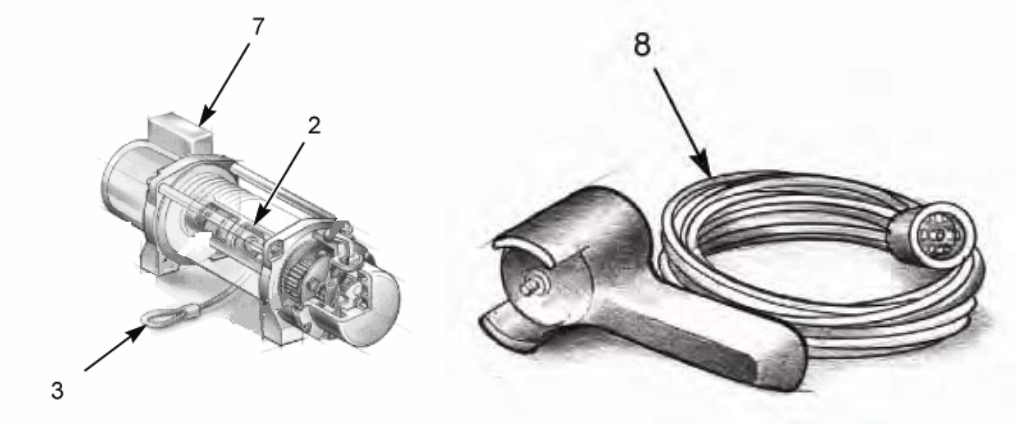
If vehicle is operational, attempt to drive out on its own power before using winch.

4. For Vehicle Recovery

    a. For vehicle recovery, you follow the same steps as above, plus continue pulling vehicle until it is on stable ground. If vehicle is able to be driven unassisted winching operation is completed.

    b. Secure the vehicle after recovery is complete. Be sure to set park brake and set transmission to NEUTRAL (N) for automatic or low gear for manual transmission before you release tension on wire rope.

5. Finished Winch Pull



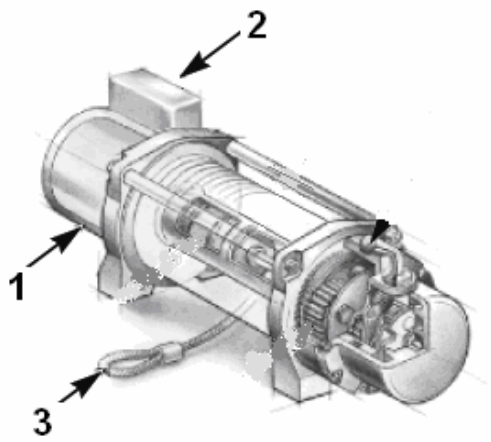
    a. When you are finished pulling item to destination area, disconnect wire rope (3).

    b. Rewind wire rope (3) by walking wire rope (3) under tension out (pay-out) and back in (pay-in) again to ensure proper alignment on the drum spool (2) using caution not to have hands on wire rope (3) at anytime while it is moving.

    c. Turn vehicle ignition off, disconnect remote control (8) from control box (7), clean if necessary and store in proper place. Winching operation is now complete.

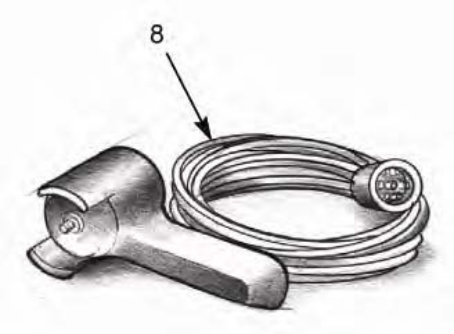
6. Cleaning of Winch and Accessories

   a. In order to keep winch in operating condition, clean it after every use.



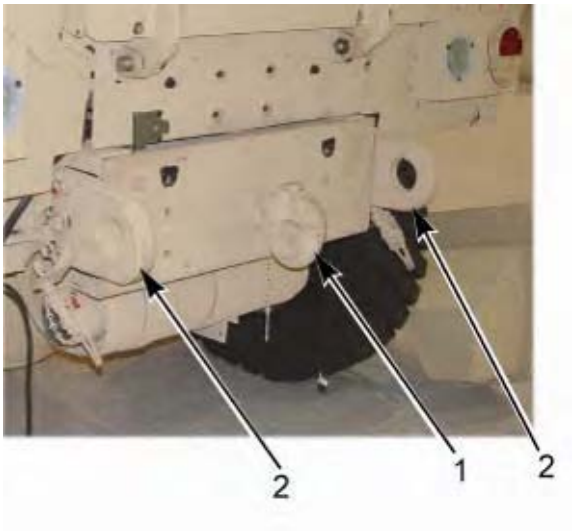
   b. After use, make sure that winch (1), switch control (2) and wire rope (3) are free of contaminants. Use a clean rag or towel to remove debris, mud, dirt.

   c. To maintain wire rope (3), unwind winch completely except for 5 wraps of wire rope (3) on drum spool (2) and apply light coat of GAA on wire rope(3).



   d. Inspect remote control (8) for any damage. Make sure the remote connector is free of debris and kept clean.

(f) Towing



This vehicle can tow a like vehicle of same gross vehicle weight (GVW). To accomplish towing this vehicle is equipped with a rear pintle (1) and shackle loops (2). The pintle of the towing vehicle will attach to the tow device of the disabled vehicle.

WARNING

When towing, ensure that all personnel are clear of vehicle before removing wheel chocks and starting vehicle towing. Personnel must not occupy vehicle being towed. Use reasonable speeds for road conditions and caution when making turns. Prior to disconnecting tow bar, ensure that vehicles are on level surface. Failure to comply may result in damage to equipment, injury, or death to personnel.

CAUTION

If no braking is available on towed vehicle, the stopping distance will be twice as long as normal.

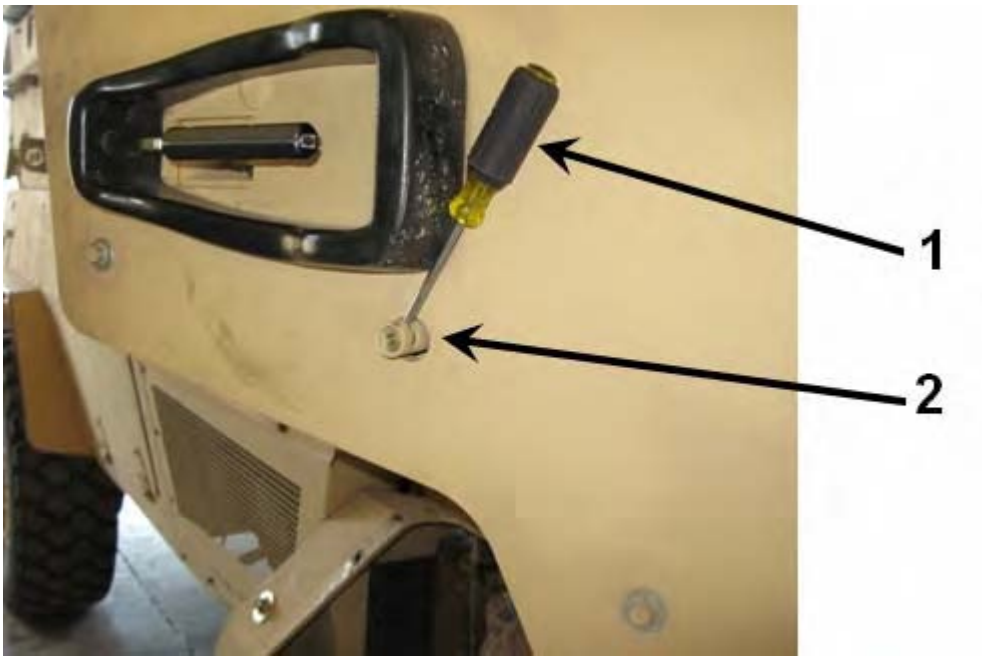
NOTE

Use safety chains to help secure the two vehicles together through the shackle loops before towing.

(g) Emergency Evacuation

Emergency rescue procedures from outside of vehicle require unlocking the combat lock.

1. Insert No. 2 crosstip screwdriver (1) into hole (2).
2. Turn screwdriver counter clockwise to unlock combat lock.



Chapter 3 - OPERATOR/CREW TROUBLESHOOTING

3-1. Introduction

In this section, you will be given some step-by-step procedures for identifying, locating, and isolating some equipment malfunctions. This manual does not list all malfunctions that may occur with this vehicle, or all tests, inspections and corrective procedure actions. If a malfunction is not listed within these charts or is not corrected by listed corrective procedure action, notify Field Maintenance.

3-2. Troubleshooting Procedures

Malfunction and Solution Chart Table

MALFUNCTION	SOLUTION
Engine Malfunctions	
Engine fails to crank when ignition switch is turned to start position.	
a. Check to see if instrument panel lights illuminate when ignition switch is turned on.	If instrument panel lights DO NOT illuminate, check battery disconnect switch.
b. Check for blown fuses and or tripped circuit breakers.	If fuse is bad or blown, replace fuse. If circuit breakers are tripped, reset them. If fuse blows again or circuit breaker trips again. Component or wiring issue, contact Field Maintenance.
c. Check to make sure transmission selector is in NEUTRAL (N) position.	If transmission selector is not in NEUTRAL (N), select NEUTRAL (N), for transmission and attempt to restart engine.
d. Check all battery connections for dirty, corroded or loose battery terminals, and/or battery cables.	If battery terminals or connections are loose or corroded, tighten and/or clean connections/terminals. If cables are damaged, notify Field Maintenance.

MALFUNCTION	SOLUTION
Engine cranks but fails to start.	
a. Oil level on dipstick. b. Check for blown fuses and tripped circuit breakers.	Add oil as needed to engine. If fuses are bad, replace fuse(s). If circuit breakers are tripped, reset by pushing center red button. When engine cools down, circuit breakers will reset themselves. If circuit breaker trips again, notify Field Maintenance.
 **Fuel is flammable and can explode. Keep fuel away from open flame and keep fire extinguisher within easy reach when working with fuel. DO NOT work on fuel system when engine is hot. Fuel can be ignited by a hot engine. Smoking is prohibited while working with fuel. Never use gasoline to clean parts. Failure to comply may result in serious injury or death to personnel.**	 **Contact Field Maintenance to perform restart procedures when vehicle is completely out of fuel. This procedure is not to be performed by the crew. Failure to comply may result in damage to equipment.**
c. Check indicator on FUEL gauge.	If fuel gauge indicates fuel tank is empty, fill tank and notify Field Maintenance to restart vehicle.
d. Check fuel level in fuel tank.	If fuel level in tank does not equal level indicated on gauge, notify Field Maintenance.
e. Reset and check air filter minder indicators.	If indicator shows RED after resetting, notify Field Maintenance.
f. Check fuel/water separator for contamination to filter or water in collection bowl.	If water and/or contamination are present, drain fuel from collection bowl until clean fuel flows out.
g. Check fuel filter for leaks and damage.	If fuel filter is leaking or damaged, notify Field Maintenance.
h. Check fuel lines and connections for leaks and damage.	If fuel lines or connections are leaking or damaged, notify Field Maintenance.
i. Check exhaust for restrictions.	If exhaust lines are kinked or dented, notify Field Maintenance.

MALFUNCTION	SOLUTION
Engine shuts down while running.	
a. Check FUEL gauge indicator.	If fuel gauge indicates fuel tank is empty, fill tank, and notify Field Maintenance to re-start engine after all safety precaution are taken.
 **Fuel is flammable and can explode. Keep fuel away from open flame and keep fire extinguisher within easy reach when working with fuel. DO NOT work on fuel system when engine is hot. Fuel can be ignited by a hot engine. Smoking is prohibited while working with fuel. Never use gasoline to clean parts. Failure to comply may result in serious injury or death to personnel.**	 **Contact Field Maintenance to perform restart procedures when vehicle is completely out of fuel. This procedure is not to be performed by the crew. Failure to comply may result in damage to equipment.**
b. Check fuel level in fuel tank.	If fuel level in tank does not equal level indicated on gauge, notify Field Maintenance.
c. Reset and check air filter minder indicators.	If indicator shows RED after resetting, notify Field Maintenance.
d. Check fuel/water separator for contamination and/or water.	If water and/or contamination are present, drain fuel from sediment bowl until clean fuel flows out.
e. Check oil level	If oil level is low, add oil, (level must be full).

MALFUNCTION	SOLUTION
Engine runs roughly after proper warm-up, does not develop full power, or makes excessive exhaust smoke.	
a. Check air filter minder indicator.	If indicator reads below 25, go to step (b). If indicator reads 25 or above, reset indicator. If indicator still reads 25 or above after resetting, notify Field Maintenance.
 **Fuel is flammable and can explode. Keep fuel away from open flame and keep fire extinguisher within easy reach when working with fuel. DO NOT work on fuel system when engine is hot. Fuel can be ignited by a hot engine. Smoking is prohibited while working with fuel. Never use gasoline to clean parts. Failure to comply may result in serious injury or death to personnel.**	
b. Check fuel/water separator for contamination and/or water.	If water and/or contamination are present, drain fuel from sediment bowl until clean fuel flows out.
c. With engine off, check fuel filter for leaks and damage.	If fuel filter is leaking or damaged, notify Field Maintenance.
d. Check fuel lines and connections for leaks and damage.	If fuel lines or connections are leaking or damaged, notify Field Maintenance.
e. Check exhaust for restrictions.	If exhaust system has kinks, dents, or other restrictions, notify Field Maintenance.
f. “Check engine” lamp on IP is illuminated.	Notify Field Maintenance
g. Check Charge Air Cooler cover for dirt/mud.	Clean cover.

MALFUNCTION	SOLUTION
Engine Overheats.	
 **Cooling system components are very hot and pressurized during vehicle operation. Allow cooling system to cool before checking hoses. Failure to comply may result in injury to personnel.**	
a. Check for debris between AC condenser, radiator, and Charge Air cooler.	
b. Check if radiator cooling fins and grill are obstructed, damaged, or plugged with dirt.	If obstructed, clear obstruction. If damaged, contact Field Maintenance.
c. Check surge tank, reservoir, radiator, and hoses for leaks and damage.	If surge tank, reservoir, radiator or hoses are leaking or damaged, notify Field Maintenance.
d. Check belt for frays and cuts.	If belt is damaged or cut, or fan blades are broken or missing, notify Field Maintenance.
Excessive engine oil consumption.	
Check under vehicle for leaks.	If any leak is found, notify Field Maintenance.

MALFUNCTION	SOLUTION
Transmission Malfunctions	
Transmission noisy when operating.	
Check transmission fluid level.	If transmission fluid level is low, add fluid as required and run transmission selector through all gears. If still noisy, notify Field Maintenance. If transmission fluid level is high, transmission is over filled, notify Field Maintenance.
Transmission temperature gauge or high transmission TEMP light indicates overheating during operation.	
a. Check transmission fluid level.	If fluid level is low, add fluid as required and run transmission selector through all gears. If still indicates high temp reading notify Field Maintenance. If fluid is high, transmission is over filled, notify Field Maintenance.
WARNING **Cooling system components are very hot and pressurized during vehicle operation. Allow cooling system to cool before checking hoses. Failure to comply may result in injury to personnel.**	
b. With engine OFF, check coolant level in coolant overflow reservoir (1).	If coolant level is low, add coolant to overflow reservoir until level is at COLD mark for a cold engine or HOT mark for hot engine. If coolant overflow reservoir is empty, notify Field Maintenance.
c. Check if radiator cooling fins, condenser and grill are obstructed or damaged.	If obstructed, clear obstruction. If damaged, notify Field Maintenance.
d. Check radiator hoses, clamps and radiator for leaks or damage.	If radiator hose clamps are loose, tighten them. If radiator hoses and/or radiator are leaking or damaged, notify Field Maintenance.

MALFUNCTION	SOLUTION
Transmission will not shift into gear or shift out of gear (CHECK TRANS light ON).	
NOTE When transmission fluid is below 19°F (-7°C), the only gears available are REVERSE (R), NEUTRAL (N), and THIRD (T) gear when DRIVE (D) is selected. Remaining gears in DRIVE (D) will not be available until fluid in sump warms above 19°F (-7°C).	
CHECK TRANS light comes on during operation. **DO NOT SHIFT INTO NEUTRAL (N) IF THE CHECK TRANS INDICATOR DASH LIGHT COMES ON!!!**	If CHECK TRANS light comes on when vehicle is operating, apply service brakes and stop vehicle. DO NOT shift into NEUTRAL (N), and perform the following Transmission Limp Home Procedure: **Transmission Emergency Operation Procedures (Limp Home)** Select REVERSE (R) on transmission range selector and note if vehicle transmission shifts. If transmission shifts into REVERSE (R), set transmission range selector to appropriate position DRIVE (D) and continue with mission. Notify Field Maintenance when the mission is complete. If transmission does not shift into REVERSE (R), transmission may be locked into a specific gear and may not come out of gear, even if engine is turned OFF. The operator must be aware that once the engine is turned OFF and NEUTRAL (N) cannot be selected, vehicle is inoperable and the mission cannot be completed until the problem is corrected.

MALFUNCTION	SOLUTION
Transmission will not shift into gear or shift out of gear (CHECK TRANS light ON). (CONT.)	
	 **When operating the vehicle in the transmission limp home mode, the operator must stay in vehicle and use only the service brakes to hold the vehicle into place. Failure to comply may result in injury or death to personnel.** Operator must be aware of the following guidelines: • Engine must not be turned OFF until you reach final destination for repair. Once engine is turned OFF vehicle will not be operable until problem is corrected. • Transmission is locked into gear and engine cannot be turned OFF, operator cannot leave cab until vehicle is dead-lined. • Vehicle will not operate in REVERSE (R). • Depending on what gear transmission is locked into, vehicle may not be able to drive up steep grades. • Brakes will need to be applied earlier than normal when stopping vehicle. • Operator must monitor the temperature gauge and transmission oil temperature, to ensure transmission does not overheat.  **If transmission overheats during limp home mode, operator should stop vehicle (DO NOT turn OFF engine), allow transmission and engine to cool down to normal operating temperatures. If engine and transmission DO NOT cool down or if overheating reoccurs, operator should turn OFF engine and notify Field Maintenance. Failure to comply may result in damage to equipment.** Once vehicle is dead-lined, operator must notify Field Maintenance. If CHECK TRANS light remains on after start-up, prior to operating vehicle, turn OFF engine, wait 15 seconds, and restart engine. If CHECK TRANS light does not stay on, fault has cleared and vehicle can be operated normally. Notify Field Maintenance. If CHECK TRANS light comes on and remains on after the second start-up, turn OFF engine, and notify Field Maintenance.

MALFUNCTION	SOLUTION
Wheel Malfunctions	
Wheel wobbles.	
a. Check wheel for loose, missing, broken lug nuts.	Tighten loose lug nuts. At end of mission, notify Field Maintenance to have lug nuts tightened to proper torque requirements.
b. Check for bent wheels, tire bulges, or bad wheel bearings.	If wheel is bent or tire has bulges, notify Field Maintenance. Bad wheel bearings will have to be replaced, notify Field Maintenance.
Steering Malfunctions	
Vehicle shimmies, wanders, or pulls to one side.	
a. Check wheel for loose, missing, or broken lug nuts.	Tighten loose lug nuts. At end of mission, notify Field Maintenance to have lug nuts tightened to proper torque requirements.
b. Check for obvious damage to steering components.	If steering components are damaged, notify Field Maintenance.
c. Check tires for proper air pressure or bad tire tread ware.	If tire air pressure is not correct, inflate tire to proper pressure.
Vehicle is hard to steer or steering is slow to respond or intermittent.	
a. Check power steering reservoir fluid level.	If fluid is low, add to full line. If empty, notify Field Maintenance.
b. Check power steering system for loose or damaged connections, lines or hoses.	If lines, hoses and/or connections are loose or damaged, notify Field Maintenance.
c. Check tires for proper air pressure.	If tire air pressure is not correct, inflate tires to proper pressure.

MALFUNCTION	SOLUTION
Air System Malfunction	
Low air audible tone sounds and low air indicator lights are on.	
a. Check air pressure gauges.	If air pressure gauges show 75 psi (517 kPa) or more, and brake system failure (low air) indicator (RED) is on, notify Field Maintenance.
b. Check that TRAILER AIR SUPPLY control is pulled out.	If not, pull out TRAILER AIR SUPPLY control.
c. Check that all air reservoir drain valves are closed.	If not, close drain valves.
d. Check air system for loose connections, leaks, and damaged hoses, lines, and/or fittings.	If connections are loose or leaking, tighten and notify Field Maintenance. If hoses, lines, fittings are damaged, notify Field Maintenance.
Trailer brakes DO NOT apply when service brake pedal or parking brake is applied.	
Check to make sure that the service and emergency air hoses are properly connected and secured.	If not, properly connect and secure the service and emergency air hoses. If connected properly, notify Field Maintenance.
Electrical System Malfunctions	
No electrical circuits operate.	
Ensure that Battery Disconnect Switch is in the ON position.	If not, turn Battery Disconnect Switch to ON position.
 **Remove all jewelry before conducting maintenance. Do not wear watches, rings, dog tags, or other jewelry which could short across battery terminals or catch on vehicle components. Failure to comply may result in injury to personnel.**	
a. Check battery cables for loose connections, corrosion, and/or damaged cables.	If battery connections are loose, tighten them. If battery connections are corroded, clean them. If battery cables are damaged, notify Field Maintenance.
b. Check for tripped circuit breakers or blown fuses.	If circuit breakers are tripped, reset circuit breakers. If circuit breakers trips again, notify Field Maintenance.

MALFUNCTION	SOLUTION
Voltage Gauge displays a reading less than 24V.	
a. Check for tripped ALTERNATOR circuit breaker or blown fuse.	If circuit breaker is tripped, reset circuit breaker. If circuit breaker trips again, notify Field Maintenance. If blown fuse, replace fuse. If fuse blows again, notify Field Maintenance.
 **Remove all jewelry before conducting maintenance. Do not wear watches, rings, dog tags, or other jewelry which could short across battery terminals or catch on vehicle components. Failure to comply may result in injury to personnel.**	
b. Check battery cables for loose connections, corrosion, and/or damaged cables.	If battery connections are loose, tighten them. If battery connections are corroded, clean them. If battery cables are damaged, notify Field Maintenance.
c. Check for tripped circuit breakers or blown fuses.	If fuses blow again or circuit breakers trip again, notify Field Maintenance.
d. Check for broken or loose belt.	If belt is broken or loose notify Field Maintenance.

MALFUNCTION	SOLUTION
Windshield washer does not operate.	
	
a. Check washer fluid level in reservoir (1).	If washer fluid level is low, fill reservoir with fluid.
b. If washers DO NOT operate, or if only one washer does not operate, check to make sure hoses are properly connected and secured.	If not, properly connect and secure hoses.
One or more lighting circuits DO NOT operate.	
NOTE Blackout select switch must be in OFF position when operating work lights. Refer to service lights operation.	
a. Check to make sure lighting system controls are in the ON positions.	If not, turn to ON position.
b. Check for tripped lighting circuit breakers or blown fuses.	If fuses blow or circuit breakers trip again, notify Field Maintenance.
c. If trailer is attached and trailer lighting system is not working, check inter-vehicular connection for loose connection, corrosion and/or damaged connectors/cables.	If cable connector is loose, reconnect cable connector. If cable connections are corroded, clean them. If cable connections are damaged, notify Field Maintenance.

MALFUNCTION	SOLUTION
Work Lights DO NOT operate.	
NOTE Blackout select switch must be in OFF position when operating work lights. Refer to service lights operation.	
a. Check that work lights are turned to ON position.	If work lights are turned OFF, turn them ON.
b. Check that light switch is in the ON position.	If moveable work light switch is in the OFF position, turn it to the ON position.
c. Check for tripped circuit breakers.	If circuit breaker is tripped, reset circuit breakers. If circuit breaker trips again, notify Field Maintenance.
Winch System Malfunctions	
Winch Does Not Pay-in or Pay-out.	
a. Check all electrical connections for proper connection, corrosion, and or damage.	If not connected, connect it. If corroded, clean it. If damaged, notify Field Maintenance.
b. Check for blown fuses and for tripped circuit breakers.	Check fuse, if bad replace fuse. If circuit breaker tripped, reset it. If it trips or blows again, notify Field Maintenance.
c. Check to make sure cable has no twists and/or tangles that would cause it to bind.	Pay-out or take up cable as necessary to straighten cable. If cable is frayed at any point, notify Field Maintenance.

MALFUNCTION	SOLUTION
Winch Unusually Noisy when Operating.	
 **To avoid injury to hands or fingers, always keep hands clear of wire rope, hook loop, hook and fairlead opening during installation, operation, and when spooling in or out. Always wear heavy leather gloves when handling a wire rope. Always remove all jewelry to avoid being caught in wire rope and wear eye protection. Never let a wire rope slip through your hands. Always be aware of possible hot surface at winch motor, drum, or wire rope during or after winch use. Always use extreme caution when handling hook and wire rope during spooling operations. Always use supplied hook strap whenever spooling wire rope in or out, during installation or operation to avoid injury to hands or fingers.** **Never use as a hoist, or to suspend a load. Never use to lift or move persons. Failure to observe these instructions could lead to serve injury or death to personnel.** **Failure to observe these instructions could result in injury to personnel. Always inspect winch installation and wire rope before operating winch. Frayed, kinked, or damaged wire rope must be replaced immediately. Loose or damaged winch installation must be corrected immediately.** **Never winch with less than five wraps of wire around the drum, the wire rope could come loose from the drum. Never touch wire rope or hook while in tension or under load. Never touch wire rope or hook while someone else is at the control switch or during winching operation. Never touch wire rope or hook while remote control is plugged into winch. Never exceed winch or wire rope rated capacity. Never engage or disengage clutch if winch is under load, wire rope is in tension, or wire rope drum is moving.** **Always stand clear of wire rope and load and keep others away while winching. Always require operator and by standers to be aware of stability during winching of vehicle and/or load. Always keep remote control lead clear of the drum, wire rope, and rigging. Inspect for cracks, pinches, frayed wires, or loose connections. Replace if damaged**.	
Check to make sure the cable has no twists, tangles, or objects caught in cable that may cause drum to bind.	Pay out or take up cables as necessary to straighten cable or remove object that is binding cable. If cable is damaged, notify Field Maintenance.

Chapter 4 - PMCS MAINTENANCE INSTRUCTIONS

4-1. OPERATOR/CREW MAINTENANCE GENERAL INFORMATION

To ensure the vehicle is ready for operation at all times, it must be inspected on a regular basis so items to be serviced may be found before they result in serious damage, equipment failure, or injury to personnel. This chapter includes Operator/Crew instructions for Preventive Maintenance Checks and Services (PMCS) necessary to maintain the vehicle.

4-2. GENERAL MAINTENANCE PROCEDURE

(a) Cleanliness

Dirt, grease, oil, and debris get in the way and may cover up a serious problem.

(b) Lubrication

General lubrication requirements for the vehicle are contained in the Lubrication Appendix (B).

(c) Nuts and Screws

Check for obvious looseness, missing, bent, or broken conditions. You cannot try them all with a tool, but look for chipped paint, bare metal, or rust around screw heads. If you find a screw or nut you think is loose, tighten it or report it to Field Maintenance.

(d) Welds

Look for loose or chipped paint, rust, or gaps where parts are welded together. If you find a cracked weld, report it to Field Maintenance.

(e) Electrical Wires and Connectors

Look for cracked or broken insulation, bare wires, and loose or broken connectors. Tighten loose connectors and make sure the wires are in good shape. If you find damaged wires or connectors, or any electrical system operating intermittently, report it to Field Maintenance.

(f) Fluid Lines, Fittings and Air Lines

Look for wear, damage, or leaks, and make sure clamps and fittings are tight. Wet spots show leaks, but a stain around a fitting or connector can also identify a leak. If a leak comes from a loose fitting or connector, tighten it. Start vehicle, let air tanks fill, shut off engine, and listen for air leaks. If any part is broken or worn out, start vehicle, listen for air leak, and report it to Field Maintenance.

(g) Damage

Damage is defined as any condition that affects safety or would render the vehicle unserviceable for mission requirements.

(h) Corrosion Control

Corrosion control maintenance is a requirement of the vehicle. WHILE PERFORMING YOUR PMCS, look for and always be aware of rust, paint peeling, blistering, damage that can cause corrosion, or other signs of corrosion. Inspect the entire vehicle as well as the specific areas mentioned in the PMCS. Also look for and always be aware of missing or damaged corrosion preventive compounds. Report problem areas as soon as possible to Field Maintenance. Having problem areas corrected as soon as possible will maximize the life of the vehicle.

Appearance and color of corrosion is dependent on the metal/components involved. The following information listed in visual Detection of Corrosion Table will aid in the visual detection of corrosion.

Visual Detection of Corrosion Table

Metal/Component	Corrosion
Steel	Powdery, Reddish-Brown Film
Aluminum	Powdery, White Film
Brass	Green Film
Electrical Connection	Green Film

(i) Fluid and Water Leakage

The following are definitions of the types/classes of leakage for determining the status of fluid systems. Become familiar with them, and remember – **WHEN IN DOUBT, NOTIFY FIELD MAINTENANCE.**

- **Class I:** Seepage of fluid indicated by wetness or discoloration that is not great enough to form drops.
- **Class II:** Leakage of fluid great enough to form drops but not enough to cause drops to fall from item being checked/inspected.
- **Class III:** Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

4-3. OPERATOR/CREW PREVENTATIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

NOTE

Prior to performing PMCS tasks, clean components as required.

Ensure the vehicle is on a hard, level surface prior to performing PMCS.

(a) General Maintenance Procedures

This paragraph contains operator PMCS requirements of the vehicle. The PMCS table contains checks and services necessary to ensure the vehicle is ready for operation. Using the PMCS Table and Lubrication Instructions, perform the maintenance at the specified intervals.

(b) Use of the PMCS Table

NOTE

Depending on mission profile of vehicle, some PMCS checks may not be applicable.

1. **Interval Column:** This column describes when and how often checks are to be made. Pay close attention to all **CAUTIONS** and **WARNINGS**. Checks and services given in the tables are for normal operation. Extreme weather conditions or periods of high use may dictate that the PMCS is performed more often than is mentioned in the PMCS Table.
    - **B (Before):** Perform BEFORE (B) PMCS just before operating the vehicle and/or its components.
    - **D (During):** Perform DURING (D) PMCS while the vehicle and/or its components are in operation.
    - **A (After):** Perform AFTER (A) PMCS right after operating the vehicle and/or its components.
    - **W (Weekly):** Perform WEEKLY (W) PMCS on a weekly basis.
    - **M (Monthly):** Perform MONTHLY (M) PMCS on a monthly basis. Perform all B and A PMCS tasks when performing monthly checks.
2. **Item to be Inspected Procedure Column:** This column lists specific items to be checked and a brief description of the procedure by which the check is to be performed.
    - If a component does not pass PMCS inspection, troubleshoot it with the instructions in this manual or notify Field Maintenance.
    - Always perform PMCS in the same order.
    - If a problem is found that is beyond your echelon of repair, report the problem to Field Maintenance.
3. **Not Mission Capable If Column:** This column contains the criteria that cause the equipment to be classified as not ready/not available because of the inability to perform its primary mission. If severity of the problem is such that you think the vehicle cannot be operated, notify Field Maintenance.

(c) Armor PMCS

Armor PMCS is limited to inspection covered in the PMCS tables. These include:

- Inspect condition of armor panels for damage and or corrosion.
- Ensure that all nuts and bolts are secure.
- First plate level may be replaced.

(d) Monthly PMCS Preperation

NOTE

Prior to performing monthly PMCS tasks, clean components as required.

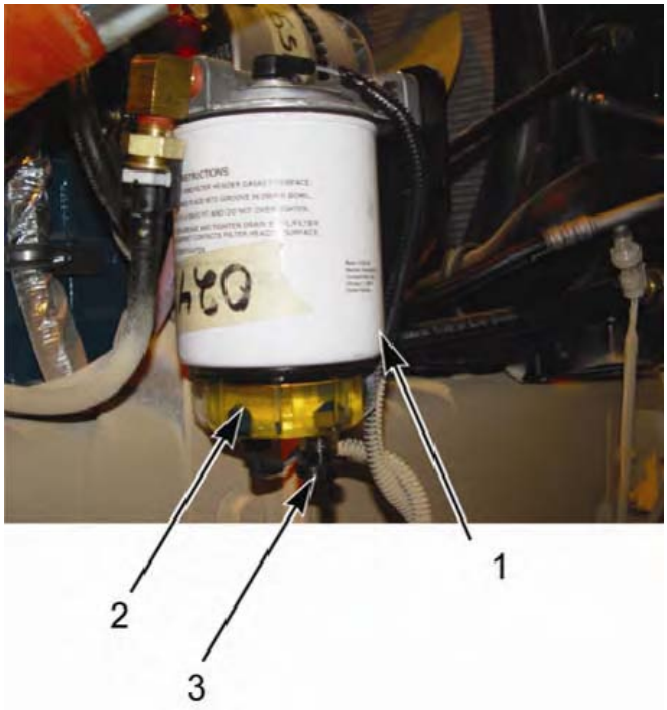
Ensure vehicle is parked on a hard, level surface with the engine shut off prior to performing PMCS.

These checks are to be made in the order listed, within designated intervals.

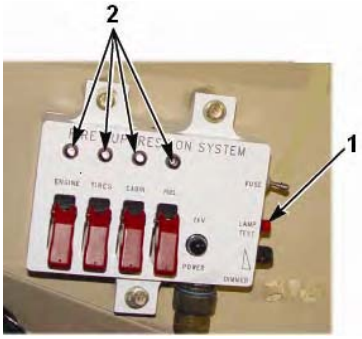
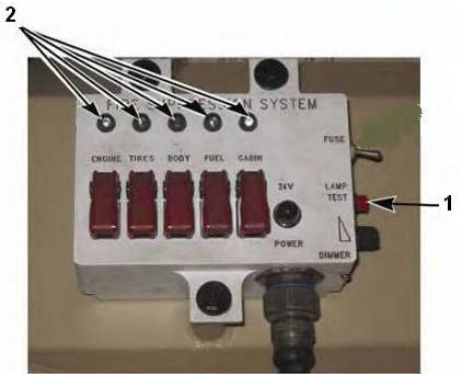
PMCS Tables

(a) Before Inspection

ITEM TO BE INSPECTED/PROCEDURE BEFORE OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Fluid leaks	
Look under vehicle for fluid leaks.	Any Fuel or Coolant Leak. Any Class III oil leaks
Exterior (front, back, sides and under vehicle)	
Check for obvious damage or missing items. Inspect all lines for damage. Check for obvious damage that would impair operation.	Lines are broke or cracked.
Windows	
Check and inspect windows for damage and dirt, wash off dirt deposits with water. Towel dry.	Window has impaired vision IAW AR 385-55
Mirrors	
Inspect for broken, dirty, cracked, or loose mirrors. Check for proper alignment, power mirrors, and heated mirrors for proper operation, and visibility is not impaired due to dirty mirrors.	
Tires (All)	
Check tread depth, tire inflation, and note if tread is evenly worn. Check tires for cuts, gouges, cracks, or other damage. See if valve caps and stems are missing, broken or damaged.	Any tire that has wear or damage that allows ply or belt material to be exposed through tread or sidewall. Any tire that has tread or sidewall separation.
Armor Panels	
	
a. Inspect condition of Armor Panels for damage, corrosion, and/or combat damage (2).	Panels that are severely combat damaged or corroded.
b. Insure that all nuts and bolts (1) are secure.	

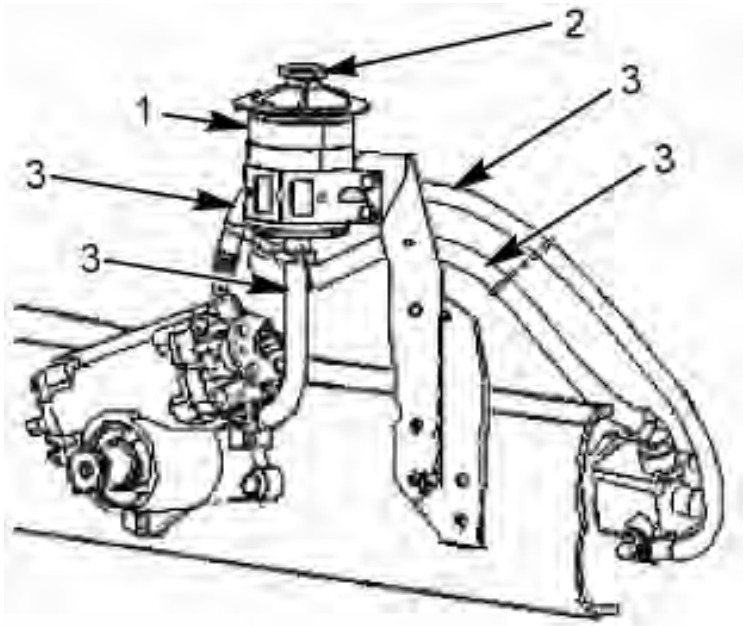
ITEM TO BE INSPECTED/PROCEDURE BEFORE OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Fuel Water Separator	
WARNING **Fuel is flammable and can explode. Keep fuel away from open flame and keep fire extinguisher within easy reach when working with fuel. DO NOT work on fuel system when engine is hot. Fuel can be ignited by hot engine. Smoking is prohibited while working with fuel. Never use gasoline to clean parts. Failure to comply may result in serious injury or death to personnel.** **Do not fill fuel tank with engine running. Do not over fill fuel tank. Clean fuel spills immediately. Ensure fuel nozzle is grounded to filler neck to prevent sparks. Failure to comply may result in injury or death to personnel and damage to equipment.** **NOTE** A flashlight may be required to perform the following two checks.	
	
a. Check fuel/water separator (1) for leaks, damage, and loose connections.	Any fuel leak.
b. Check sediment bowl (2) for water. If water is present, drain fuel from bowl into a suitable container until clean fuel flows out. To drain from sediment bowl, turn out drain valve (3) until water and contaminated fuel are allowed to drain from sediment bowl. Close drain valve (3) once all water and contaminated fuel is drained from sediment bowl.	

ITEM TO BE INSPECTED/PROCEDURE BEFORE OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Fuel Tank	
WARNING **Fuel is flammable and can explode. Keep fuel away from open flame and keep fire extinguisher within easy reach when working with fuel. DO NOT work on fuel system when engine is hot. Fuel can be ignited by hot engine. Smoking is prohibited while working with fuel. Never use gasoline to clean parts. Failure to comply may result in serious injury or death to personnel.** **Do not fill fuel tank with engine running. Do not over fill fuel tank. Clean fuel spills immediately. Ensure fuel nozzle is grounded to filler neck to prevent sparks. Failure to comply may result in injury or death to personnel and damage to equipment.**	
	
a. Using a flashlight, check fuel tank (1) for adequate fuel level. Check fuel tank strainer for dirt, and debris.	

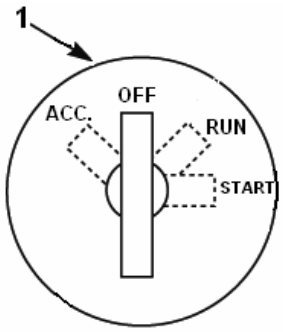
ITEM TO BE INSPECTED/PROCEDURE BEFORE OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
FSS Control Panel	
There are two FSS systems available for the I-MPV. They are:	
	
CAT I Four monitoring areas (engine, tires, cabin, fuel)	
	
CAT II Five monitoring areas (engine, tires, body, fuel, cabin)	
a. Press the lamp test button (1) to check the lights on the operation panel.	Any system that has been discharged notify Field Maintenance
b. An indicator warning light (2) will come ON if a system is being operated or needs repairs.	

ITEM TO BE INSPECTED/PROCEDURE BEFORE OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Engine Oil Level	
	
Check oil level in engine. With engine off, pull dipstick (1) out and wipe with clean rag. Re-insert dipstick to fully seat and pull back out again. Oil level should be between the full and add hash marks. DO NOT OVERFILL; this will cause the engine to overwork and overheat. If low refill to proper level.	If overfull notify Field Maintenance

ITEM TO BE INSPECTED/PROCEDURE BEFORE OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Coolant Overflow Tank and Coolant Level	
WARNING **The engine cooling system is hot and pressurized. Do not remove the radiator cap while the engine is hot; steam and hot coolant can escape and burn personnel. Allow the system to cool and remove the cap slowly to relieve pressure. Failure to comply may result in serious injury or death to personnel.** **Coolant is poisonous if ingested. Avoid skin and eye contact. If skin contact occurs wash the affected area immediately with soap and water. If eye contact occurs flush with water and seek medical attention. Failure to comply may result in injury to personnel.**	
	
a. Open Hood and check coolant level in coolant overflow tank (1) when engine is cold. Ensure level is above the cold mark. If coolant is below **ADD** mark, add coolant to bring it up to **MAX** level.	Any leak.
b. Check coolant overflow tank and cap for damage and leakage.	
c. Look through the plastic reservoir and make sure the fluid is within the minimum and maximum fluid level range as marked on the reservoir. **DO NOT Remove Pressure Cap Until Coolant Has Cooled.**	

ITEM TO BE INSPECTED/PROCEDURE BEFORE OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Power Steering System	
	
a. Check that power steering fluid is between the two marks on the white plastic reservoir (Cold MAX level and Hot MIN Level). If fluid is below Cold MAX, add fluid until between Cold MAX and Hot MIN level.	
b. Check reservoir (1) for leaks, damage, and secure mounting.	Any Class III leak.
c. Check hoses (3), connections, cap (2), and filter for looseness, leaks, and damage.	Any Class III leak.

ITEM TO BE INSPECTED/PROCEDURE BEFORE OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Seatbelts	
	
a. Inspect belts for proper operation (1). Make sure that anchor mountings (2) are tight and there is no fraying of seat belt material.	Seat belt does not operate.

ITEM TO BE INSPECTED/PROCEDURE BEFORE OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Seat Mounts	
	
a. Check and inspect all seats (1). Be sure seats are firmly engaged to avoid forward or rearward movement when starting or stopping. Make sure that anchor mounting fasteners to the floor as well as tether straps to floor or cab-back are tight and straps are not worn.	Seat unable to be secured correctly.
Fire Extinguisher Equipment	
a. Inspect portable fire extinguisher equipment for any signs of damage or leaks.	
b. Check that fire extinguisher bottle is secure.	
Starter	
	
a. Check that starter (1) engages smoothly and engine starts properly.	Engine does not start.

ITEM TO BE INSPECTED/PROCEDURE BEFORE OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Rear Ramp	
	
a. Check ramp hinges and mounting hardware (1) for cracked or broken hinges, missing or loose hinge bolts or nuts.	Ramp hinges are cracked or broken; mounting hardware is missing or has loose bolts or nuts.
b. Check area under ramp pumps (2) for leaks.	Class III leak on any ramp pump.
c. Check mounting pin and lock pins on ramp pumps.	Any mounting pin cracked, broken, or missing. Any lock pin missing.
d. Check hydraulic lines from the top of the ramp pump to the reservoir.	Any hydraulic line that is cut, bulging or any Class III leak.
e. Check ramp door seal for cuts, tears, or missing door seal.	Door seal missing or will not seal properly.

ITEM TO BE INSPECTED/PROCEDURE BEFORE OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Ballistic Glass	
 **Do not use ammonia or any cleaning product that contains ammonia to clean ballistic glass. Ammonia breaks down the bond between the inner and outer sections of ballistic glass. Do not use aerosol window cleaners. The aerosol propellant may also cause ballistic glass separation**.	
a. Check ballistic glass for damage that would impair operator's vision.	Ballistic glass is cracked, broken, or discolored (cloudy) sufficiently to impair operator's vision
b. Inspect inner surface of ballistic glass (spall liner) for complete breaks, delamination, scratches, gouges, tape, decals, adhesives or blurred vision.	The bond between glass and frame is separated from glass or frame. Any complete break on inner surface of glass. Any digs, gouges, or scratches on inner surface of glass. Any complete break on inner surface of glass.

(b) During Inspection

ITEM TO BE INSPECTED/PROCEDURE DURING OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Engine	
a. Listen for any unusual noises. Report them upon completion of mission	
b. Inspect filter minder gauge on dash for filter element air restriction indication. For element replacement, see “Air Cleaner Element Service” in the Maintenance section.	
c. Check transmission fluid level (1) after vehicle has been running and engine is warmed up. Transmission needs to be warmed up to get an accurate reading on dipstick.	Fluid level hot and cold above full mark or below minimum on dipstick.
 	
Air Pressure	
	
a. The low air pressure warning should sound immediately after the engine starts but before the air compressor has built up pressure. The low air pressure warning should stop when the air pressure gets to 70 psi or more. Let the air pressure build to governed-cut-out pressure, which should occur between 115 to 130 psi.	Unable to build or maintain air pressure.
Brakes	
a. Check service brake for excessive pedal travel or loss of stopping power.	Brakes are malfunctioning.

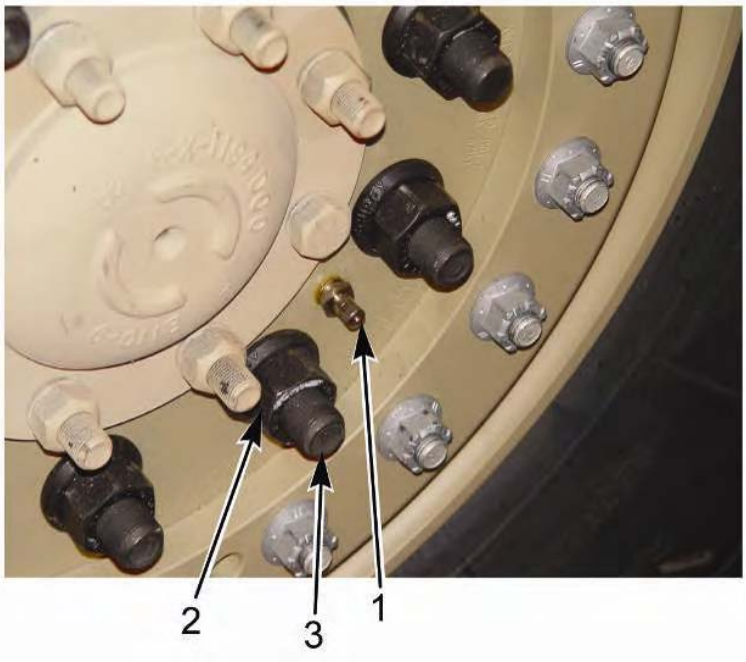
ITEM TO BE INSPECTED/PROCEDURE DURING OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Instruments and Instrument Panel	
	
a. Check for operation of all panel gauges and switches. The following checks should be made with the engine running.	If any gauge needle points to 6 o'clock a malfunction is indicated. Notify Field Maintenance.
b. Check to see that oil pressure is building to (15psi) normal. Engine oil pressure gauge should begin a gradual rise to normal operating range.	Low oil pressure.
c. Check the voltmeter gauge to see if the alternator is charging.	Alternator not charging or alternator over charging.
d. Check the filter restriction gauge to see that it is within the acceptable range.	

ITEM TO BE INSPECTED/PROCEDURE DURING OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Wiper/Washer System	
	
a. Check and test wiper washing system (1). Check for worn rubber on blades, blades securely mounted on wiper arms, and that wipers work.	Wipers inoperative.

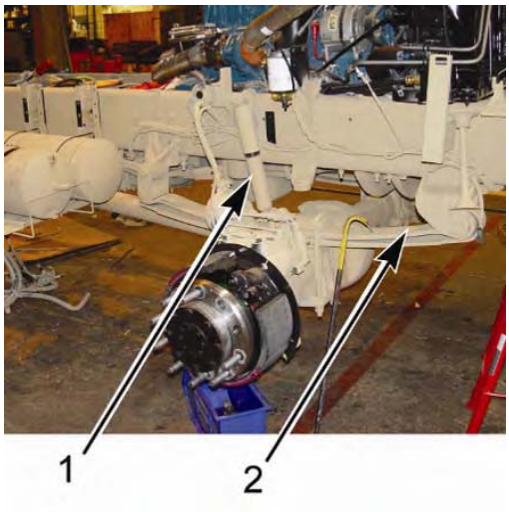
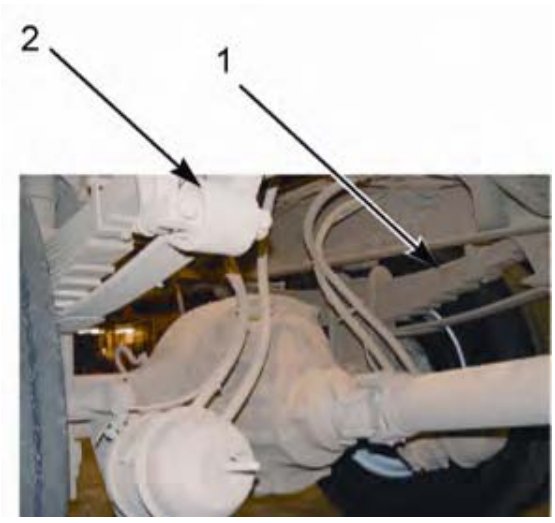
ITEM TO BE INSPECTED/PROCEDURE DURING OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Lights and Horn	
	
a. Check to see that all lights (1) illuminate and are clean.	
b. Check operation of horn (2) by turning the ignition switch to on and turning on the lights, and pressing the horn.	

ITEM TO BE INSPECTED/PROCEDURE DURING OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Steering	
a. Check power steering to ensure that no binding occurs.	Steering gear is malfunctioning.
Transmission	
a. Check operation for smooth shifting through gears.	Transmission is malfunctioning.
Four-Wheel Drive	
a. Check for proper shifting in and out of four-wheel drive.	

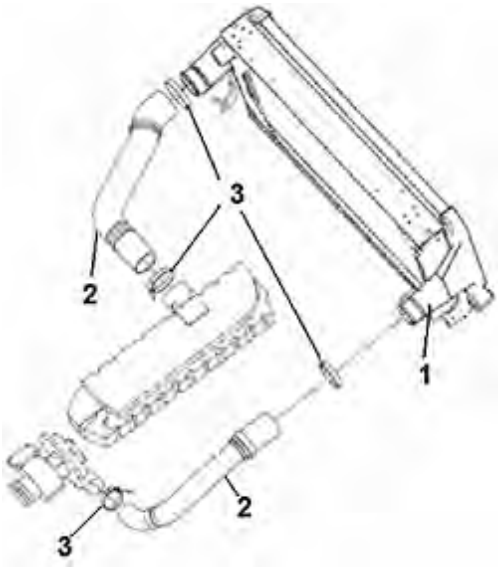
(c) After Inspection

ITEM TO BE INSPECTED/PROCEDURE AFTER OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Windows	
a. Check and inspect windows for damage and dirt, wash off dirt deposits with water. Towel dry.	Window has impaired vision IAW AR 385-55
Exterior (front, back, sides and under vehicle)	
a. Check for obvious damage or missing items. Inspect all lines for damage. Check for obvious damage that would impair operation.	Lines are broke or cracked.
Tires (All)	
	
a. Check tread depth, tire inflation, and note if tread is evenly worn. Check tires for cuts, gouges, cracks, or other damage. See if valve caps and stems are missing, broken or damaged.	Any tire that has wear or damage that allows ply or belt material to be exposed through tread or sidewall. Any tire that has tread or sidewall separation.
b. Check wheels for broken, cracked, or bent surfaces.	Wheel is broken, cracked, or bent.
c. Check wheel nuts (2) and wheel studs (3) for obvious looseness or damage. Tighten loose nuts.	Two or more in consecutive order wheel nuts and/or wheel studs are missing or damaged.
d. Check that valve cap (1) is securely tightened.	
e. Check wheel hub oil seal for leaks.	Hub oil seal leak. Class III

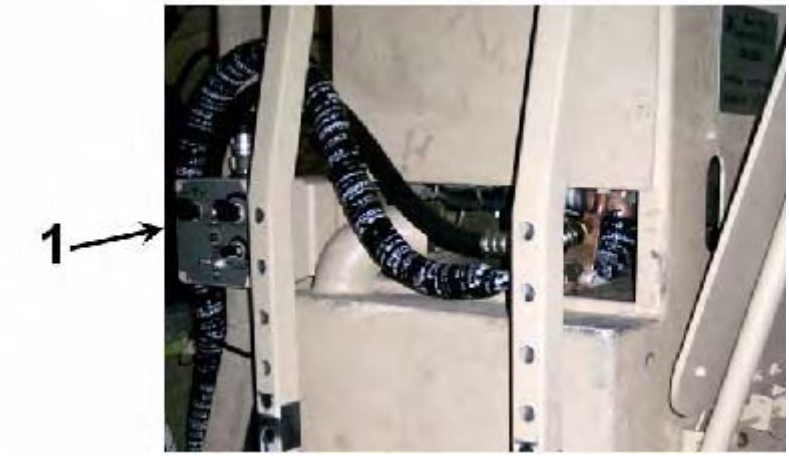
ITEM TO BE INSPECTED/PROCEDURE AFTER OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
External Air Tank (1)	
	
a. Check for obvious missing mounting hardware.	Air tank not secure.
b. Listen for audible air leaks.	Air leaking

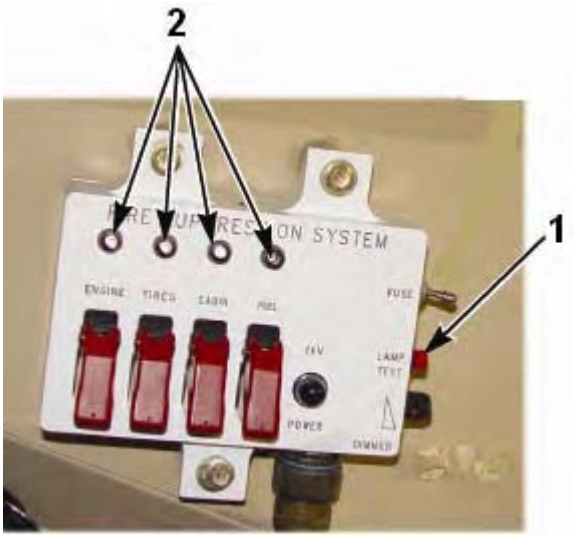
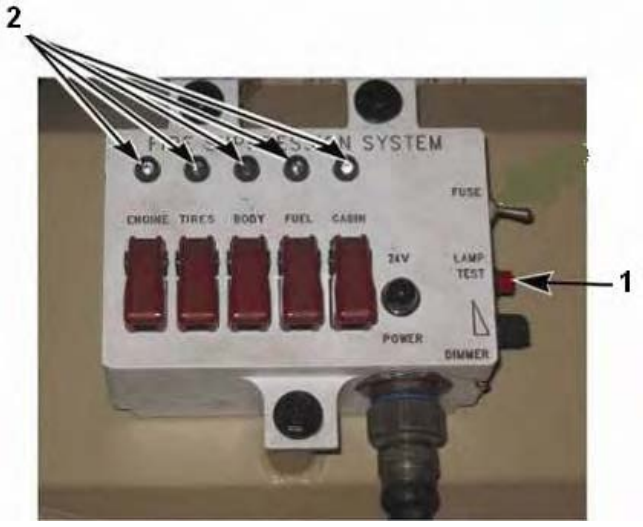
ITEM TO BE INSPECTED/PROCEDURE AFTER OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Shock Absorbers and Leaf Springs	
NOTE Shock absorbers may have a thin film of oil on the outer surface due to a normal condition known as “misting”. Misting is not considered a leak and will not be evident as a stream of fluid.	
	
a. Check shock absorbers (1) on front axle for leaks and damage.	
b. Inspect leaf springs (2) on front axle for cracks, broken leafs, or obvious damage.	
	
c. Inspect leaf springs (1) on rear axle for cracks, broken leafs, or obvious damage.	
d. Check to see that there are no broken, missing, or loose bolts (2); missing or damaged bushings; broken, loose, or missing axle mounting parts.	Any broken, damaged, or missing mounting parts.

ITEM TO BE INSPECTED/PROCEDURE AFTER OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Engine Oil Level	
 	
a. Check oil level in engine. With engine off, pull dipstick (1) out and wipe with clean rag. Re-insert dipstick to fully seat and pull back out again. Oil level should be between the full and add hash marks. DO NOT OVERFILL; this will cause the engine to overwork and overheat. If low fill to proper level.	If overfull notify Field Maintenance.

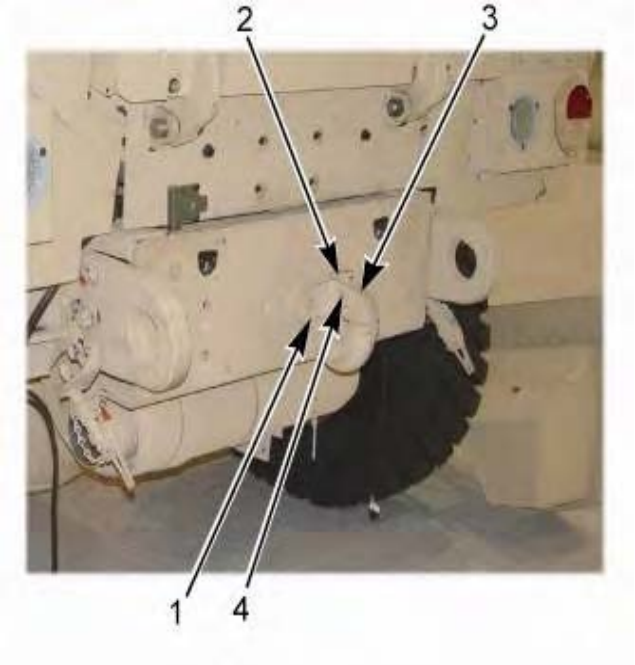
ITEM TO BE INSPECTED/PROCEDURE AFTER OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Radiator/Cooling and Charged Air Cooler System	
a. Check cooling system for leaks.	Any leaks.
b. Check for radiator damage, loose or broken, or dirt build-up.	Radiator damage that would hinder operation.
	
c. Check coolant level in reservoir (2). Add 50/50 mixture of coolant and water to reservoir as required.	
	
Charged Air Cooler (CAC) System: inspect mounting to radiator connections (1) for cracks, check hoses (2) for weakness, cracks, ruptured/worn areas, couplings and clamps (3) for tightness and signs of corrosion or rust.	Cracks and damage that would hinder operation

ITEM TO BE INSPECTED/PROCEDURE AFTER OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Engine	
a. With the engine OFF, press the serpentine belt (fan, alternator, water pump, air compressor and refrigerant compressor) to test that it is snug. Check for frays, cracks, loose fibers, or visible signs or wear.	Belt slippage or worn belt.
Windshield Wiper Fluid Level	
	
a. Check windshield wiper fluid reservoir (1) fluid level. Inspect the reservoir and verify that the fluid level is up to the full mark. If additional fluid is required, see “Lubricant and Sealer Specifications” chart, in the Maintenance section, for the correct fluid type before fillings.	
Walk around vehicle looking for obvious leaks.	
	
a. Inspect under vehicle for leaks.	Any Class III leak

ITEM TO BE INSPECTED/PROCEDURE AFTER OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
HVAC/LSS Filtration System	
a. Check operation and the air flow of the Heating and Cooling system.	
	
b. Make sure that nothing is obstructing the filters or the flow of air into the system; Control Panel (1), and Air Duct. **NOTE** NBC Filter must only be handled by authorized personnel.	NBC Unit is inoperative * In War Time Only*

ITEM TO BE INSPECTED/PROCEDURE AFTER OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
FSS Control Panel	
There are two FSS systems available for the I-MPV. They are:	
	
CAT I Four monitoring areas (engine, tires, cabin, fuel)	
	
CAT II Five monitoring areas (engine, tires, body, fuel, cabin)	
a. Press the lamp test button (1) to check the lights (2) on the operation panel.	If light does not work, notify Field Maintenance.

(d) Weekly Inspection

ITEM TO BE INSPECTED/PROCEDURE WEEKLY OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Pintle Hook	
	
a. Check pintle hook (1) for secure mounting and proper operation. Ensure safety latch (2) engages hook lock (3).	
b. Ensure safety pin (4) is secure and functional.	

ITEM TO BE INSPECTED/PROCEDURE WEEKLY OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Diagnostic Trouble Code Access Procedure	
To display Electronic Control Module (ECM) Diagnostic Trouble codes (DTC) using the Electronic Service Tool (EST) refer to Diagnostic Testing Section. You can display ECM Diagnostic Trouble codes when the EST is not available while out on a mission by using the following procedure: 1. When you have an AMBER or RED engine lamp on the gauge cluster, pull over as soon as safely possible. 2. Put transmission in NEUTRAL (N) and turn engine OFF. 3. Set parking brake, turn the ignition switch to the ON position. 4. Press and release the CRUISE ON and the RESUME/ACCEL buttons simultaneously, (at the same time). If codes are present, they will be flashed out using the RED and AMBER engine lamps on the gauge cluster.	
To read the DTCs, you will need to count each time the AMBER engine lamp flashes, continue with the following sequence below. This sequence occurs each time the cruise control buttons are depressed together to access the DTCs. 1. The RED engine lamp will flash once to indicate the beginning of ACTIVE DTCs. 2. The AMBER engine lamp will flash repeatedly signaling the ACTIVE DTCs. **NOTE** All DTCs are three digits. Code 111 indicates no Diagnostic Trouble Codes have been detected. 3. Count the flashes in sequence. After each digit of the code a short pause will occur. Three flashes and a pause would indicate the number 3. Two flashes and a pause, three flashes and a pause, and two flashes and a pause would indicate the DTC 232. If there is more than one DTC, the RED engine lamp will flash once in between to indicate the beginning of a new DTC. After all active DTCs have flashed, the RED engine lamp will flash twice, two times, to indicate the start of INACTIVE DTCs. Count the flashes of the AMBER engine lamp as before with the ACTIVE DTCs. If there is more than one inactive code, the RED engine lamp will flash once in between each DTC found. After all DTCs have been sent, the RED engine lamp will flash three times indicating END OF MESSAGE.	
Perform Diagnostic Trouble Code Access Procedure	Any code other than 111

(e) Monthly Inspection

ITEM TO BE INSPECTED/PROCEDURE MONTHLY OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Cab Exterior	
a. Inspect door hinge pins and fasteners for damage or misalignment.	
b. Check for cracks or bends in longitudinal frame members. Make sure there are no loose, cracked, bent, broken, or missing crossmembers or crossmember fasteners.	Bent frame, cracked, bent, broken, or missing crossmembers.
Slave Receptacle	
	
a. Inspect slave receptacle for damage and missing cover or cap (1).	

ITEM TO BE INSPECTED/PROCEDURE MONTHLY OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Batteries	

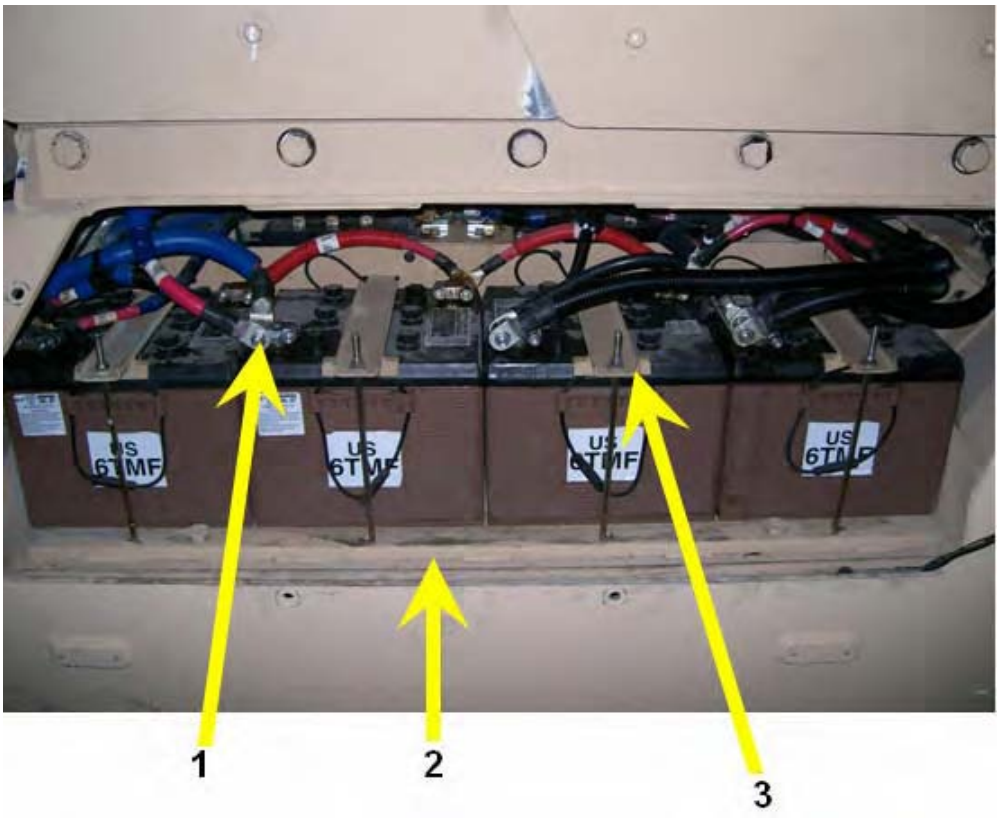
WARNING

Care must be taken when handling or working near batteries. Hydrogen gas emitted from the batteries is flammable and hazardous to health. Do not smoke, have open flames, or make sparks around a battery. Battery acid (electrolyte) is extremely harmful. Wear acid-proof gloves, eye protection, and rubber apron to prevent contact. In the event of skin or eye contact, flush with cold water and seek medical attention. Avoid inhaling battery vapors and immediately discard all rags after wiping the batteries and battery box. Failure to comply may result in severe burns, respiratory problems, and damage to equipment.

Ensure batteries are disconnected when performing maintenance on or near batteries or electrical systems. Ensure stored voltage is discharged from equipment before conducting maintenance. Always remove negative battery terminals first. When reconnecting, always connect positive terminals last to avoid arcing or sparks that could cause an explosion. DO NOT allow tools to contact battery box or other battery terminals when removing or installing terminals. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

NOTE

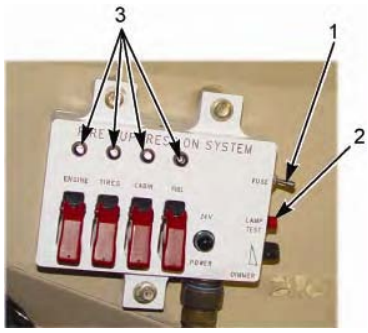
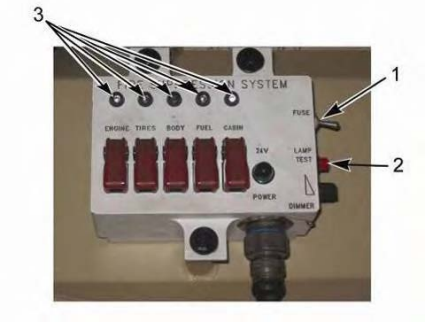
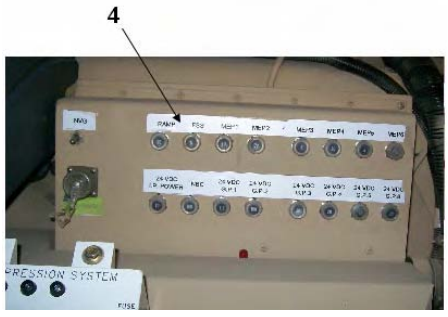
Remove five bolts to lower armor cover.

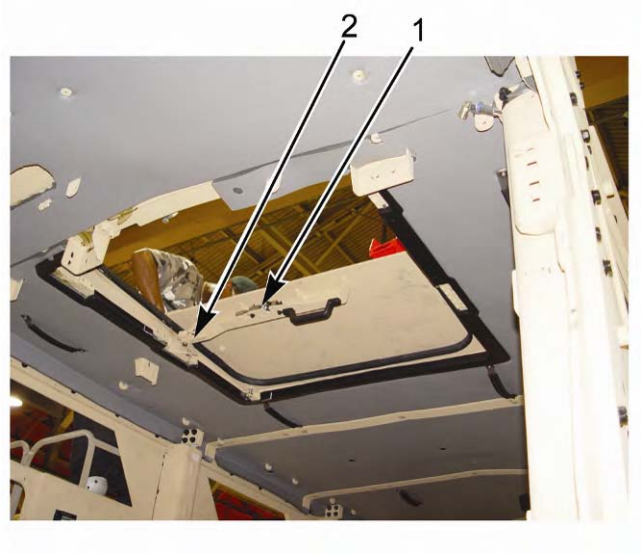


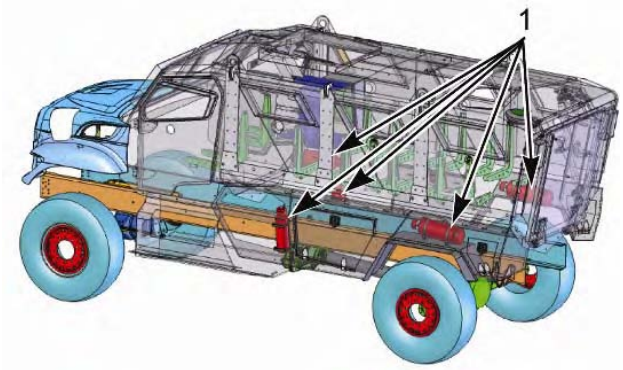
a. Check terminals and clamps (1), battery tray (2), and tie (hold) down rods (3). Ensure battery is secure.	Battery not secure.

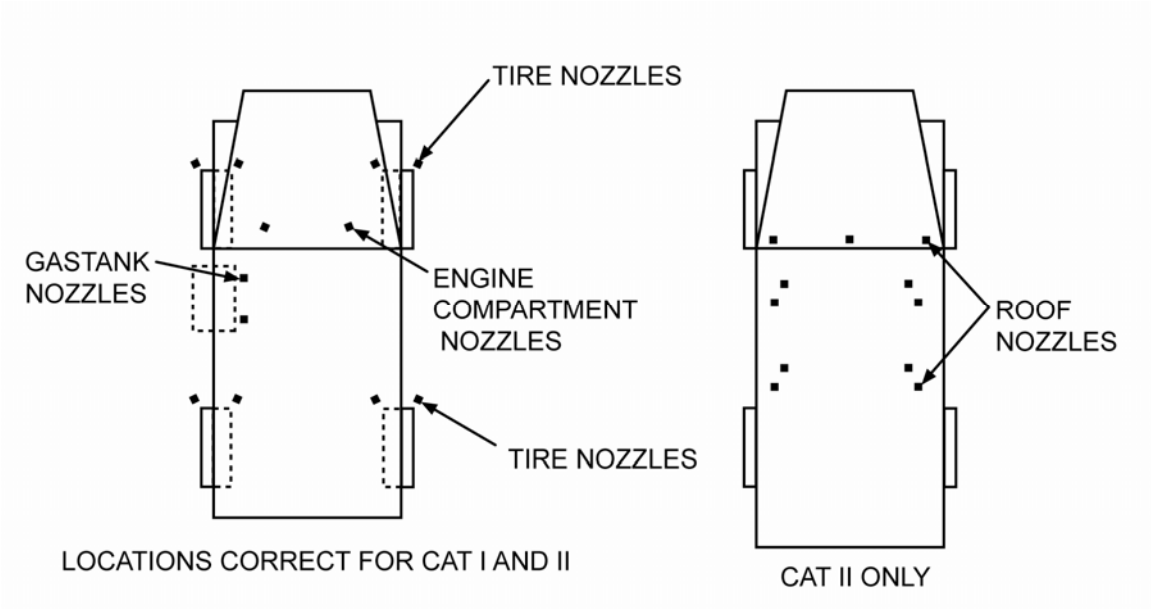
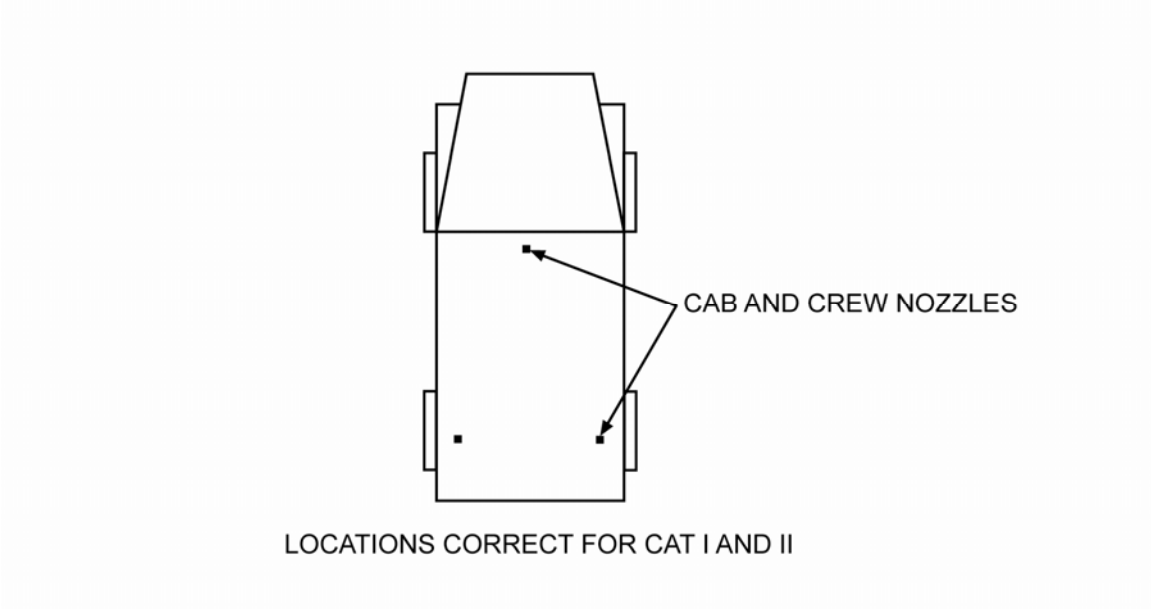
ITEM TO BE INSPECTED/PROCEDURE MONTHLY OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Fuel Tank	
WARNING **Fuel is flammable and can explode. Keep fuel away from open flame and keep fire extinguisher within easy reach when working with fuel. DO NOT work on fuel system when engine is hot. Fuel can be ignited by hot engine. Smoking is prohibited while working with fuel. Never use gasoline to clean parts. Failure to comply may result in serious injury or death to personnel.** **Do not fill fuel tank with engine running. Do not over fill fuel tank. Clean fuel spills immediately. Ensure fuel nozzle is grounded to filler neck to prevent sparks. Failure to comply may result in injury or death to personnel and damage to equipment.**	
	
a. Check fuel tank (1) mounting hardware looseness or damage at every fill up.	

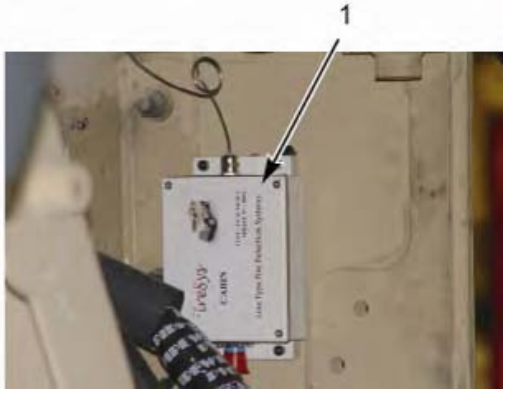
ITEM TO BE INSPECTED/PROCEDURE MONTHLY OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Brakes	
1. Check the air brakes in the following manner: a. Push in parking brake and Tractor Protection Valve (TPV) knobs. The TPV should only be pushed in if a trailer is coupled with the vehicle. b. Check the air compressor or governor cut-out pressure (approximately 120 psi). c. Shut OFF engine and TURN IGNITION SWITCH BACK ON. d. Without brake pedal applied, note air pressure drop for one minute. It should be less than 2 psi for single vehicles, 3 psi for combinations. e. Depress and hold brake pedal and make sure there is no more than a 3 psi per minute drop. **NOTE:** Service drive lights must be on before audible warning will operate. f. Step on and off brake pedal, to decrease system air pressure, and check for warning light and buzzer to come on at about 70 +/- 6 psi. g. Step on and off brake, to decrease system air pressure, and check to make sure the tractor protection and parking brake knobs pop out between 20 to 45 psi (138 to 310 kPa). h. Restart engine, shift into a low gear, and gently pull against service and parking brakes separately to make sure they will hold.	Brakes are malfunctioning.
2. Check front and rear brake hoses for cracked, worn, or frayed hoses, and for secure couplings.	Hoses cracked, frayed, or worn.
3. Check front and rear brake chambers to see that brake chambers are not cracked, rusted, or dented and that they are securely mounted.	Brake chambers are cracked, loose, or rusted.
4. Check front and rear slack adjusters for broken, loose, or missing parts. Angle between push rod and adjuster arm should be approximately 90 degrees when brakes are applied. When pulled by hand, push rod should not move more than approximately one inch.	Slack adjusters are broken, loose, or have missing parts. Push rod does not operate properly.
5. Check front and rear drums and brake shoes to ensure there are no cracks, dents, or holes; no loose or missing bolts. Check to see that brake shoes (where visible) are not worn dangerously thin or contaminated by lubricant.	Loose or missing hardware or grinding noise from brakes.
Transmission	
Check to see that accessible drive shafts are not bent or cracked. Ensure that all shaft couplings are secure.	Bent or cracked drive shaft.

ITEM TO BE INSPECTED/PROCEDURE MONTHLY OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
FSS Control Panel	
There are two FSS systems available for the I-MPV. They are:	
	
CAT I Four monitoring areas (engine, tires, cabin, fuel)	
	
CAT II Five monitoring areas (engine, tires, body, fuel, cabin)	
	
a. Inspect fuse switch (1) for proper operation. Switch should activate and deactivate power to the FSS control box.	
b. Press the lamp test button (2) to check the lights (3) on the operation panel. If lights do not come on check the FSS circuit breaker (4). Push circuit breaker in to reset.	If any light does not come on notify Field Maintenance.

ITEM TO BE INSPECTED/PROCEDURE MONTHLY OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Gunner's Hatch	
WARNING **Ensure that the gunners hatch is in the locked position before moving the vehicle. Use extreme caution when standing in gunner's hatch while vehicle is in motion; gunner should be holding onto the weapon or other suitable handle to maintain a stable posture at all times. Failure to comply may result in serious injury or death to personnel.**	
	
Make sure the gunner's hatch (1) latch (2) is securely in the open position. Clean and lubricate as needed.	Gunner's hatch does not operate.
Winch	
a. Check operation of winch control lever.	
	
b. Inspect cable condition for frayed or kinked sections (1).	

ITEM TO BE INSPECTED/PROCEDURE MONTHLY OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Fire Extinguisher Cylinders and Brackets	
NOTE The CAT I vehicle will have four fire suppression cylinders. The CAT II vehicle will have five fire suppression cylinders.	
	
a. Confirm that all fire suppression cylinders (1) are mounted on the vehicle.	
b. Check each cylinder (1) to ensure that pressure gauge or indicator is in the operable range on the cylinder gauge.	If incorrect pressure is found notify Field Maintenance.
c. Check the brackets for each cylinder (1) to ensure that all bolts, nuts, and fasteners are on the bracket and are tight.	

ITEM TO BE INSPECTED/PROCEDURE MONTHLY OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Foam Dispersant Nozzles and Fittings	
	
Make visual inspection of nozzles and fittings (1) for cleanliness.	
Water Mist System	
	
a. Make visual inspection of three nozzles (1) for obstructions.	
b. Make visual inspection of nozzles (1) and nozzle fittings for cleanliness.	
c. Make visual inspection of nozzle hoses.	
d. Make visual inspection of mist tank located under NBC box.	

ITEM TO BE INSPECTED/PROCEDURE MONTHLY OPERATING VEHICLE: Check for and have repaired, filled, or adjusted as needed.	Not Mission Capable If:
Cab Protection Sensor	
	
Location: Under the passenger's dash board; mounted on the right wall	
a. Visually inspect the sensor and the sensor wires for the cab protection sensor (1) for wear, kinks, and for proper connections. Check and investigate any warning lights that come on.	Any warning lights come on.
Engine Protection Sensor	
	
a. Lift the hood, and inspect the sensor and the sensor wires for the engine protection sensor (1) for wear and for proper connections.	
b. Inspect sensor detection tubes, connectors, and plastic bands. Check for kinks, (chafing), and that items are securely mounted.	Broken wires; warning lights come on

Chapter 5 – MAINTENANCE INSTRUCTIONS

5-1 MAINTENANCE

(a) Wheel and Tire Assembly Remove and Replace Procedures

WARNING

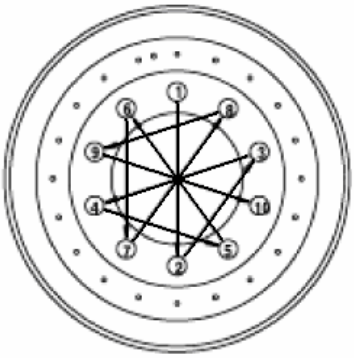
Wheel and tire assembly is heavy. DO NOT attempt to lift or catch wheel and tire assembly without the aid of an assistant and a suitable lifting device. Failure to comply may result in serious injury or death to personnel.

Vehicle must be parked on hard, level surface where jacks will be level. Attempting to change wheel/tire assembly on non-level or soft surface may result in jack/jack stand and/or vehicle falling. Failure to comply will result in equipment damage and or serious injury or death to personnel.

1. Shut vehicle engine OFF, turn Battery Disconnect Switch to OFF position, set parking brake, place transmission in NEUTRAL (N), and chock wheels.
2. With suitable lifting device in place, loosen the ten lug nuts on the tire assembly.
3. Raise the vehicle high enough to remove tire and wheel assembly. Ensure vehicle is high enough to install the replacement tire that will be slightly higher. Install jack stand.
4. Loosen and remove bolts for hubcap. Loosen and remove ten lug nuts. With aid of an assistant remove tire and wheel assembly.
5. With aid of an assistant, line up and install replacement tire and wheel assembly on axle drum.
6. Install ten lug nuts and adjust tire and wheel assembly before tightening lug nuts.
7. Lug nuts need to be tightened in a specific order for proper installation of tire and wheel assembly.

NOTE

Notify Field Maintenance to torque to proper specifications.

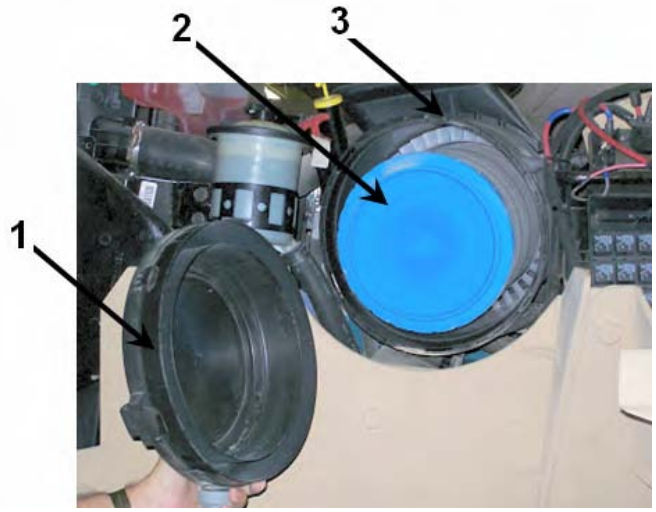


LUG NUTS

8. Once tightened, raise vehicle up slightly to remove jack stand, then lower vehicle to ground and tighten lug nuts once it is on solid ground.

(b) Servicing Air Filters

1. Remove



NOTE

Air filters should be inspected and replaced at suggested maintenance intervals, after heavy exposure to “hard” conditions such as dust or sand, or if the filter minder gauge indicates.

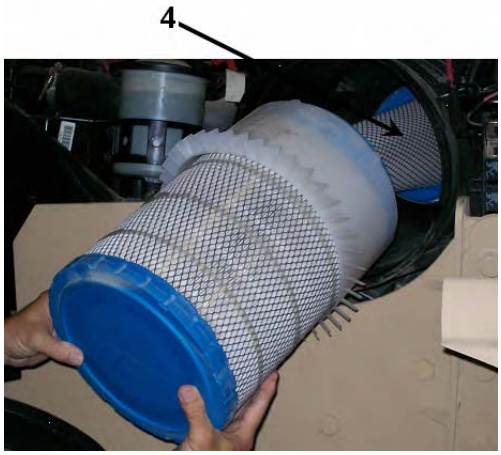
NOTE

Do not attempt to start engine with filter removed.

NOTE

If vehicle left unattended with cover and/or filter removed, cover filter housing to prevent foreign objects from entering air intake

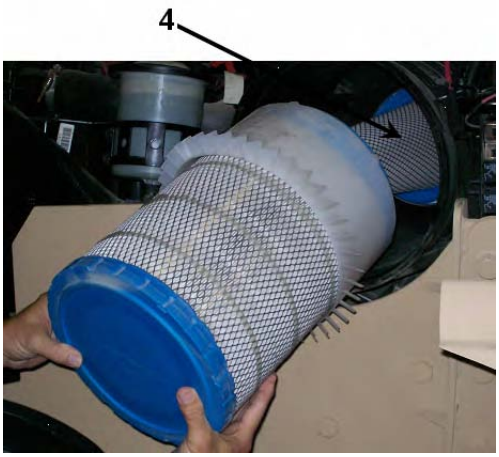
a. Remove the cover (1) of the air filter (2) by twisting slightly counterclockwise and lifting up and away from the canister (3).
b. Remove the outer filter by pulling straight out. Discard.
c. Remove the inner filter (4) by pulling straight out. Discard.



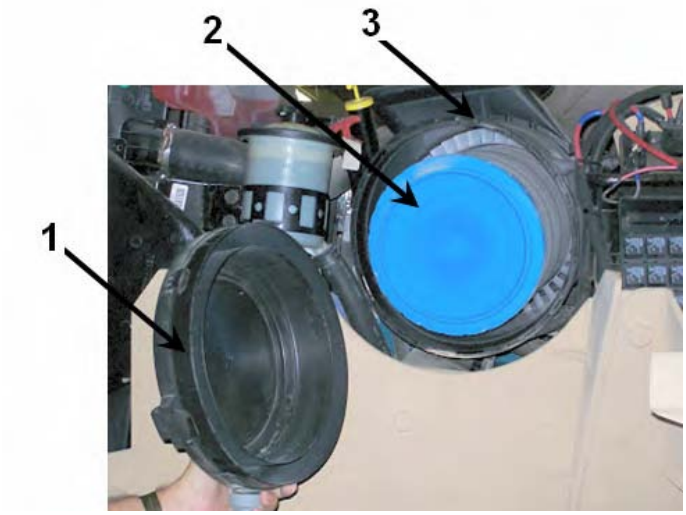
2. Replace

NOTE

After initial installation of a new air filter, the vehicle's air restriction indicator gauge, may initially read in the lower area of its viewing window. This is normal, and should not be mistaken as a signal for element service.



a. Insert a new inner filter (4) into the canister. Check to confirm that it is properly seated.



b. Place a new outer filter (2) into the canister. Check to confirm that it is properly seated.

c. Replace the air filter canister cover (1) by pushing down and twisting clockwise until the cover tabs engage.

(c) Cleaning Radiator

1. Servicing

NOTE

The vehicle's charge air cooler, radiator, and condenser are all serviced in the same manner.

a. The vehicle is equipped with charge air cooling system. The function of the charge air cooler is to cool the hot compressed air before it enters the engine's intake manifold. This system uses ambient air as the cooling medium by allowing the intake air to pass through a network of heat exchanging fins and tubes prior to entering the combustion chamber.

b. Clean the heat exchanging fins in the radiator (1) of any and all debris, dirt, leaves, etc. with a water hose (avoid using high pressure or caustic solutions to avoid damage to radiator veins). After operating in mud, dust, or dirt, and cannot get the radiator clean, contact Field Maintenance.

(d) Windshield Washer Service

1. Inspect the fluid level for the windshield washer fluid reservoir (1). Do not overfill.
2. Grasp the tab of the reservoir cap (2) and lift gently.
3. Pour washer fluid into reservoir until it reaches the "MAX" indicator.
4. Replace the reservoir cap.

(e) DRAIN AIR SYSTEM

WARNING

Protective eye goggles or face shields need to be worn. Air drain valves are under pressure. DO NOT allow face to be in front of air drain valves while draining air reservoirs. Open air valves slowly to prevent sudden blast of air. Failure to comply may result in serious injury or death to personnel.

1. Shut engine OFF.
2. Battery Disconnect Switch OFF.
3. Parking brake set.
4. Transmission set in NEUTRAL (N).
5. Chock the wheels.
6. Pull drain air release cord (1) located on front of brake air tank (2).

NOTE

Hold the drain release open for 8 to 10 seconds. This should be sufficient to drain the condensation from both tanks. If condensation is still evident, pull cord again until clear.

It is not necessary to drain all the air from the tanks. Drain only long enough to remove condensation.

7. When condensation is no longer draining, release cord.

(f) FUSE REPLACEMENT

1. Check fuse box for blown fuses.
2. Fuses of the prong type are replaced by pulling them out and replacing with the exact same style and size of fuse.

APPENDIX – A ABBREVIATIONS AND ACRONYMS

A-1. ABBREVIATIONS AND ACRONYMS

The abbreviation or acronyms for a particular part or service procedure are followed by definitions.

Abbreviation or Acronym	Definition
A or amp	Ampere
ABS	Antilock Brake System
A/C	Air Conditioner
ACC	Ignition Accessory Control
AFFF	Aqueous Fire-Fighting Foam
BII	Basic Issue Items
C	Celsius
CAC	Charge Air Cooler
CAP	Cold Ambient Protection
cm	Centimeter
DOD	Department Of Defense
DT	Diesel Turbocharged
ECM	Electronic Control Module
ECU	Electronic Control Unit
EGC	Electronic Gauge Cluster
ELC	Extended Life Coolant
EOD	Explosive Ordnance Disposal
F	Fahrenheit
F/A	Fresh Air
ft-lb	Foot-Pounds
GVW	Gross Vehicle Weight
hp	Horsepower
HVAC	Heating, Ventilation, and Air-Conditioning
ICS	Intercom System
IED	Improvised Explosive Device
in.	Inch
I-MPV	International - Mine Protected Vehicle
IP	Instrument Panel
IPS	Integral Particle Separator
I.R.	Infrared
kg	Kilogram
km	Kilometer

Abbreviation or Acronym	Definition
km/h	Kilometers Per Hour
kPa	Kilo Pascal
lbs	Pound(s)
L	Liter
LCD	Liquid Crystal Display
LED	Light-Emitting Diode
LSS	Life Support System
m	Meter
mph	Miles Per Hour
mm	Millimeter
mph	Miles Per Hour
MRAP	Mine Resistant Ambush Protected
NATO	North American Treaty Organization
NBC	Nuclear, Biological, Chemical
N•m	Newton Meters
PMCS	Preventive Maintenance Checks and Services
P/N	Part Number
psi	Pounds Per Square Inch
pt	Pint
qt	Quart
R/A	Recycled Air
RCIED	Remote Controlled Improvised Explosive Device
RFI	Radio Frequency Interference
RPG	Rocket-Propelled Grenade
rpm	Revolutions Per Minute
SAE	Society of Automotive Engineers
SAF	Small Arms Fire
V	Volt

APPENDIX – B LUBRICATION INSTRUCTIONS

B-1. LUBRICATION INSTRUCTIONS

a) Introduction

New vehicles are lubricated before they are delivered. After the vehicle is placed in operation, regular lubrication intervals, based on the type of service and road conditions, should be established.

The interval between lubrication periods, oil changes, etc. depends entirely upon operating conditions. The loads carried, the vehicle speed, the road and the weather conditions all contribute to the frequency of lubrication periods.

In some types of operation, and where operating conditions are extremely severe (such as in deep water, mud or unusually dusty conditions), the vehicle may require lubrication after every twenty-four (24) hours of operation.

The lubrication specifications refer only to the viscosity (SAE) and type to be applied. The viscosity numbers have been adopted by the Society of Automotive Engineers to classify lubricants according to viscosity and do not cover any other properties.

Unless otherwise specified, never add lubricant unless it is the same grade as that which is already in use. If the grade is unknown or not available, drain, flush and refill with new lubricant.

b) Lubrication Intervals

Lubrication intervals are provided for normal highway, city, and severe service. In all applications the actual interval should be performed at whatever interval occurs first, whether it is months, miles (kilometers), hours of operation, or passage of time (months).

Lubrication Interval Chart Symbols Key Table

Symbol	Interval Definition		
	City < 59,000 mi/yr	**Highway > 60,000 mi/yr**	**Severe Service <20,000 mi/yr**
A	10,000 miles (16,000 km) 300 hours 6 months	15,000 miles (24,000 km) 450 hours 9 months	5,000 miles (8,000 km) 135 hours 3 months
B	20,000 miles (32,000 km) 600 hours 12 months	30,000 miles (48,000 km) 900 hours 18 months	10,000 miles (16,000 km) 300 hours 6 months

Lubrication Interval Chart Notes

NOTE

A hand-pumped grease gun should be used for optimal grease distribution within the component joint.

Kingpin thrust washers must be lubricated with vehicle weight on tires. Kingpins and kingpin bushings must be lubricated with weight off of the wheel and tires.

Certain services are performed at special intervals or in addition to A or B Service when the interval dictates.

Lubrication Interval Chart Table

System	Item	Intervals	Lubrication Used/ Special Intervals (3): miles (km) / hours / months
Front Axle	Tie Rod Ends – Lubricate (1)	A,B	Fleetrite Lithium Complex based Moly grease P/N 991044C2 or equivalent GC/LB NLGI#2 Multi-purpose Lithium Complex grease.
	Drag Link – Lubricate (1)	A,B	Fleetrite Lithium Complex based Moly grease P/N 991044C2 or equivalent GC/LB NLGI#2 Multi-purpose Lithium Complex grease.
	King Pins and Bushings – Lubricate (1,2)	A,B	Fleetrite Lithium Complex based Moly grease P/N 991044C2 or equivalent GC/LB NLGI#2 Multi-purpose Lithium Complex grease.
	Wheel Bearing – Change Oil 16 pints (85W140)	B	Multipurpose EP gear lube of API GL-5 quality meeting MIL-PRF-2105E specs including *synthetic lubricants. Do Not Mix conventional lube with Synthetic lube.

System	Item	Intervals	Lubrication Used/ Special Intervals (3): miles (km) / hours / months
Rear Axle	Rear Axle with Synthetic Oil – Change - 39.5 pints (85W140)		120000(192000)/--/12
Steering	Power Steering Fluid - Approx. 5.5 quarts	A,B	15W40 Engine Oil
	Steering Gear – Lubricate	A,B	ATTN: Install grease slowly at low pressure. Power grease guns may blow out seals.
	Steering Intermediate Shaft U-Joints/Slip Joint – Lubricate	A,B	
	Power Steering Fluid - Change		40000(64000)/--12
	Power Steering Filter – Replace		500000(800000)/15000/60
Drive Shaft "SPL"	U-Joints – Lubricate	B	Fleetrite Lithium Complex Base Moly grease P/N 991044C2 or equivalent GC/LB NLGI #2 Multipurpose Lithium Complex grease
Drive Shaft "Non-booted Slip Joint"	U-Joints and Slip Joint – Lubricate		5000/8000/--/3 Fleetrite Lithium Complex Base Moly grease P/N 991044C2 or equivalent GC/LB NLGI #2 Multipurpose Lithium Complex grease
Air Brakes	S-Cam Bushings – Lubricate	A,B	
Engine	Extended Life Coolant – Add Extender		Refer to Engine Operation and Maintenance Manual
	Extended Life Coolant – Replace 55 gallon ELC Concentrate ROTELLA 940410055 55 gallon 50/50 premix ROTELLA 94042000055 1 gallon ELC Concentrate ROTELLA 9404106021 1 gallon 50/50 premix ROTELLA 9404206021		Shell Rotella Extended Life Coolant (ELC) Red in Color Refer to Engine Operation and Maintenance Manual

System	Item	Intervals	Lubrication Used/ Special Intervals (3): miles (km) / hours / months
Engine	Air Filter(s) - Replace		@ Restriction Indication or 60 months
	Engine Oil & Filter(s) – Replace Lube Oil without oil filter – With Front Drive Steer Axle 22.7 liters (24 quarts) Without Front Drive Steer Axle 24.6 liters (26 quarts) Lube Oil with oil filter – With Front Drive Steer Axle 26.4 liters (28 quarts) Without Front Drive Steer Axle 28.4 liters (30 quarts)		API Classification CI-4 or later 15W-40 10°F and above P/N 2643576R1
	Fuel Filter - Replace		
Transmission	Automatic/Manual Trans Fluid/Filter – Replace 29 quarts		Tran Synd synthetic, or equivalent TES-295 or Dextron VI
Transfer Case	4.5 quarts less cooler, 5.5 quarts with cooler		SAE 50 synthetic oil only per TP-90114 (See CAUTION below)
Cab Components	Door Hinges/Latches/Strikers - Lubricate	A,B	Multi-purpose lithium grease or light engine oil. DO NOT use silicone lubricant
	Door Lock Cylinders – Lubricate	A,B	
	Seat Adjuster Slides – Lubricate	A,B	
	BIL Storage Internal, External		

USE ONLY SYNTHETIC SAE 50W OIL IN THE TRANSFER CASE. DO NOT check the oil level cold. Check the oil level within 30 minutes of the vehicle being driven (over one mile). Failure to follow this CAUTION may result in damage to the transfer case.

Unit Refill Capacities

Refill Capacities Table

Unit	Model	Liters	Quarts
Front Drive Axle	Meritor	17	18
Rear Axle	Meritor	14.7	31
Transfer Case (w/o cooler)	Meritor	4.3	9 pints

Cooling System Refill Capacities

Cooling system refill capacities vary considerably due to differences in engine models, size of the radiator models, in addition to the amount of coolant remaining in the system after draining. Total capacity may range from 6 to 22 gallons. If system has been drained, fill with a 50/50 mixed of Extended Life Coolant (ELC) concentrate and demineralized water, or ELC 50/50 Premix. If the system has been flushed with water, a significant amount of the freshwater flush will remain in the system. In this case refilling with a mixture with a higher percentage (60% to 66%) of concentrate is advised in order to achieve a final mixture closer to 50/50. Fill the system and run the vehicle until the thermostat opens. Check the coolant concentration and add additional water or concentrated undiluted coolant to adjust the concentration. Run the vehicle and retest.

Lubricant and Sealer Specifications Table

Item	Lubrication Specification
Engine Oil with Filter	30 qt (28.3L) 15W 40 Cl-4
Cooling System	88 qt
Radiator	70 qt (66.2L) ELC
Overflow tank	10 qt (9046 L)
Transmission with Filter - Dry	29 qt TransSynd (TES-295)
Transmission with Filter-Drain and Refill	19 qt TransSynd (TES-295)
Axle-Front	18 qt (17L) – (85W140)
Wheel Ends	1.6 qt (1.5L)
Rear Door/Ramp Hydraulic Fluid	6.5 qt AW30
Power Steering Reservoir	5.5 qt – (15W-40)
Transfer Case w/o cooler	4.5 qt SAE 50W (0-81)
Windshield Wiper Fluid	4 qt (3.7 L) Solvent
A/C System	6.5 lb (R134A)

APPENDIX – C EXPENDABLE DURABLE SUPPLIES LIST

C-1. EXPENDABLE DURABLE SUPPLIES LIST

a) Scope

This appendix lists expendable and durable items that are needed to operate and maintain the I-MPV. This listing is for informational purposes only and is not authority to requisition the listed items. These items are authorized by CTA 50-790, Expendable/Durable Items (except medical, Class V, repair parts, and heraldic items), or CTA 8-100, Army Medical Department Expendable/Durable Items.

b) Explanation of Columns

1. **Item Number (Column (1) -** This number is assigned to the entry in the listing and may be referenced in the narrative instructions to identify the item (e.g., "Use detergent, general purpose, Item 4, Appendix D").
2. **Level (Column (2) -** This column identifies the lowest level of maintenance that requires the item. One of the following codes appears in Column 2:
   - C – Operator/Crew
   - F – Field Maintenance
3. **National Stock Number (Column (3) -** This is the national stock number assigned to the item. Use it to requisition the item.
4. **Item Name, Description, Commercial and Government Entity (CAGE) code, and Part Number Column (4) -** This provides the other information needed to identify the item.
5. **Unit of Measure (U/M) Column (5) -** This code shows the physical measurement or count of an item, such as gallon, gross, etc.

Expendable and Durable Supplies Table

(1) Item No	(2) Level	(3) NSN	(4) Item Name Description, CAGE, and Part Number	(5) U/M
1	C	8030-00-009-8246	**ANTI SIEZE COMPOUND:** P/N A768, Cage 05045	ea
2	C		**BRUSH:** Scrub (81348) H-B-1490-7-P1	ea
3	C		**BRUSH:** Wire (17987) 3577	ea
4	C	7930-00-282-9699	**DETERGENT:** General Purpose, Liquid (83421)	gal
5	C		**GLOVES:** Protective (58536) A-A-50022	pr
6	C	9150-01-456-3780 P/N PKMOS138-1.5%P	**LUBRICANT, CONNECTOR:** , Cage OAG11	
7	C		**OIL:** Refrigerant PAG Oil (62534) RD-5-7166-OP	
8	C	7920-00-205-1711	**RAG:** Wiping (64067) - 50 pound bale	lb
9	C		**R134A:** Tetafluorethane, Technical (2S827) HFC-134A - 43 lb cylinder	lb
10	C		**SEALANT:** Adhesive, Silicone Rubber (94833) 52498 - 5 oz tube	kt
11	C		**SOLVENT:** Dry cleaning (Environmentally Compliant Solvent) (0K209) Breakthrough - 5 gallon can	gal
12	C	9905-00-537-8954	**TAG:** Marker (64067) - 50 each	ea
13	C		**TAPE:** Duct (39428) 1791K70	ro
14	C		**TIE, WIRE:** Strap, Tie-down, Electrical Components, Nylon (62534) RD-5-4021-0	ea

APPENDIX – D BII (BASIC ISSUE ITEMS)

D-1. BII (BASIC ISSUE ITEMS)

NOTE

BII for this vehicle has not been determined as of date of printing.

a. Introduction

This appendix lists Basic Issue Items (BII) for the I-MPV to help you inventory the items for safe and efficient operation of the equipment.

b. General

These essential items are required to place the vehicle in operation, operate it, and to do emergency repairs. Although shipped separately packaged, BII must be with the vehicle during operation and when it is transferred between property accounts. Illustrations are furnished to help you find and identify the items.

c. Explanation of Columns

The following provides an explanation of columns found in the tabular listings:

Column (1) – Illustration Number (Illus No.).

This column indicates the number of the illustration in which the item is shown.

Column (2) – National Stock Number (NSN).

Indicates the National Stock Number assigned to the item and will be used for requisitioning purposes.

Column (3) – Description, Part No., and usable On Code, if applicable.

Indicates the Federal item name and, if required, a minimum description to identify and locate the item. The last line of each item indicates the part number.

Column (4) – Unit of Issue (U/I).

Indicates the quantity issued when ordering the component. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea., pr.).

Column (5) – Quantity Required (Qty Rqr).

Indicates the quantity of the item authorized to be used with/on the equipment.

Appendix D
Components of End Items (COEI) Table

Item	Nomenclature			QTY	Supplier	P/N	Location
1	Machine Gun Ring						
2	Armored Machine Gun Ring Protection						
3	Fasteners						

Basic Issue Items (BII) Table

Item	Nomenclature			QTY	Supplier	P/N	Location
1	Pioneer Kit						back of vehicle
1.1	Ax, Fiberglass Handle			1			
1.2	Pick			1			
1.3	Shovel D Handle			1			
1.4	Ax Sheath			1			
2	Brake Chamber Caging Tool			1			in tool box
3	Air Chuck Gage and Hose			1			left side stowage box
4	Padlock For Tool Box and Stowage Area			3			left/right stowage boxes
5	Hammer Ball Pin 16 oz			1			in tool box
6	Sledge Hammer 8 lb			1			left side stowage box
7	Pliers Side Cutter			1			in tool box
8	Adjustable Wrench 15 in.			1			in tool box
9	Adjustable Wrench 10 in.			1			in tool box
10	Screw Driver Flat Tip 3/8x12			1			in tool box
11	Screw Driver Flat Tip 3/16x6			1			in tool box
12	Screw Driver Cross Tip #4			1			in tool box
13	Screw Driver Cross Tip #2			1			in tool box

Item	Nomenclature			QTY	Supplier	P/N	Location
14	Chock Blocks			4			left side stowage box
15	Bottle Jack 20T With Handle And Pad			1			left side stowage box
16	Warning Triangle			1			left side stowage box
17	First Aid Kit						crew area
18	Pry Bar 16 in.						left side stowage box
19	Tankers Bar 60 in.						mounted on top of left side stowage box
20	Work Light With Extension						in rear right side stowage area
21	Winch Control Cable Assembly						left side stowage box
22	Lug Wrench Assembly						left side stowage box
23	Block and Tackle for Winch						attached to winch mounting
24	Flashlight						in tool box
25	Batteries for Flash Light						in tool box
26	Ratchet 1/2 in. Drive						in tool box
26	Socket Set Metric						in tool box
27	Socket Set Std						in tool box
28	Tool Box						left stowage box
29	Cargo Tie Down Strap						left stowage box
30	Grease Gun						

Item	Nomenclature			QTY	Supplier	P/N	Location
31	Bag Pamphlet For TM						left stowage box
32	Vehicle Log Book						in crew area
33	Tech Manual - Operators						manual bag
34	Pliers Slip						tool box

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is DAAG.	Use Part II (reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
TO: (Forward to proponent of publication or form) (Include ZIP Code) PM-MRAP, AMSTA-LC-GMM, 6501 E. 11 Mile Road, Warren, MI 48397-5000	FROM: (Activity and location) (Include ZIP Code)	

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 9-2355-106-10		Operator Manual COTS for International Mine Resistant Vehicle Category 1 2355-01-533-4634 Category II 2355-01-553-4636

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

* Reference to line numbers within the paragraph or subparagraph.

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO: *(Forward direct to addressee listed in publication)*	FROM: *(Activity and location) (Include ZIP Code)*	DATE

PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III - REMARKS *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

USAPA V3.01

By Order of the Secretary of the Army:

GEORGE W. CASEY, JR.
General, United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army
0726005

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 990003, requirements for TM 9-2355-106-10.

THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meter = 0.3937 Inch
1 Decimeter = 10 Centimeters = 3.94 Inches
1 Meter =10 Decimeters = 100 Centimeters
= 1000 Millimeters = 39.37 Inches
1 Dekameter = 10 Meters = 32.8 Feet
1 Hectometer =10 Dekameters = 328.08 Feet
1 Kilometer =10 Hectometers = 1000 Meters
= 0.621 Mile = 3,280.8 Feet
Millimeters = Inches times 25.4
Inches = Millimeters divided by 25.4

WEIGHTS

1 Centigram = 10 Milligrams = 0.154 Grain
1 Decigram = 10 Centigrams = 1.543 Grains
1 Gram = 0.001 Kilogram = 10 Decigrams
=1000 Milligrams = 0.035 Ounce
1 Dekagram = 10 Grams = 0.353 Ounce
1 Hectogram = 10 Dekagrams = 3.527 Ounces
1 Kilogram = 10 Hectograms = 1000 Grams
= 2.205 Pounds
1 Quintal = 100 Kilograms = 220.46 Pounds
1 Metric Ton = 10 Quintals = 1000 Kilograms
= 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liter = 0.034 Fluid Ounce
1 Centiliter = 10 Milliliters = 0.34 Fluid Ounce
1 Deciliter = 10 Centiliters = 3.38 Fluid Ounces
1 Liter = 10 Deciliters = 1000 Milliliters
= 33.82 Fluid Ounces
1 Dekaliter = 10 Liters = 2.64 Gallons
1 Hectoliter = 10 Dekaliters = 26.42 Gallons
1 Kiloliter = 10 Hectoliters = 264.18 Gallons

SQUARE MEASURE

1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inch
1 Sq Decimeter = 100 Sq Centimeters = 15.5 Sq Inches
1 Sq Meter (Centare) = 10 Sq Decimeters
= 10,000 Sq Centimeters = 10.764 Sq Feet
1 Sq Dekameter (Are) = 100 Sq Meters = 1,076.4 Sq Feet
1 Sq Hectometer (Hectare) = 100 Sq Dekameters
= 2.471 Acres
1 Sq Kilometer = 100 Sq Hectometers
= 1,000,000 Sq Meters = 0.386 Sq Mile

CUBIC MEASURE

1 Cu Centimeter = 1000 Cu Millimeters = 0.061 Cu Inch
1 Cu Decimeter = 1000 Cu Centimeters = 61.02 Cu Inches
1 Cu Meter = 1000 Cu Decimeters
= 1,000,000 Cu Centimeters= 35.31 Cu Feet

TEMPERATURE

5/9 (°F - 32°) = °C
(9/5 x °C) + 32° = °F
-35° Fahrenheit is equivalent to -37° Celsius
0° Fahrenheit is equivalent to -18° Celsius
32° Fahrenheit is equivalent to 0° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
100° Fahrenheit is equivalent to 38° Celsius
212° Fahrenheit is equivalent to 100° Celsius

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds-Inches	Newton-Meters	0.11375
Pounds per Square Inch	Kilopascals	6.895
Ounce-Inches	Newton-Meters	0.007062
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621
°Fahrenheit	°Celsius	°C = (°F-32)x5/9
°Celsius	°Fahrenheit	°F = (9/5x°C)+32

PIN: 084301-000