



Effects of Cold on Vehicles



Terminal Learning Objective:



Action: Operate vehicles in the cold weather environment

Condition: In temperatures of 32° F to -60 °F, given the requirement to maintain and operate a military vehicle, and the correct technical manual and lubrication orders for the vehicle.

Standard: Identify the common problems with cold weather vehicle operation. Take steps to reduce or eliminate problems caused by the cold before, during, and after operations.



Cold Conditions



COLD- few problems down to 10°F; for temperatures 10° to -25°F special considerations for operations such as winterization of vehicles; below -25°F routine tasks become complex

CONDENSATION- occurs when cold equipment is quickly exposed to a warmer environment

SNOW- introduces moisture to equipment and causes mobility problems; increases equipment loss

FROZEN SURFACES- hinders emplacement of stakes, grounding rods; creates unstable firing platforms; possible contact frostbite



Effects on Materials



METALS- brittle in severe cold; at -20°F certain metals (especially steel) can't withstand a shock load

RUBBER- remains flexible until below -20°F

RUBBER COVERED CABLES- easily cracked at low temp; should be re-warmed before bending

PLASTICS- generally expand and contract more than metals

GLASS- windshields may crack if heat is applied too rapidly

FABRICS- retain flexibility if kept dry; shrinkage can occur



Maintenance Plans



Maintenance plans must include:

- Shelter to sized to accommodate equipment
- Portable heaters and lighting
- PPE for maintenance personnel
- Repair parts on hand
- Storage for fluids
- Snow and ice removal

Plan on lag time for equipment to thaw before being serviced.

Recovery assets will become vital

USARAK 750-1 January 2014

USARAK 750-4 February 2006



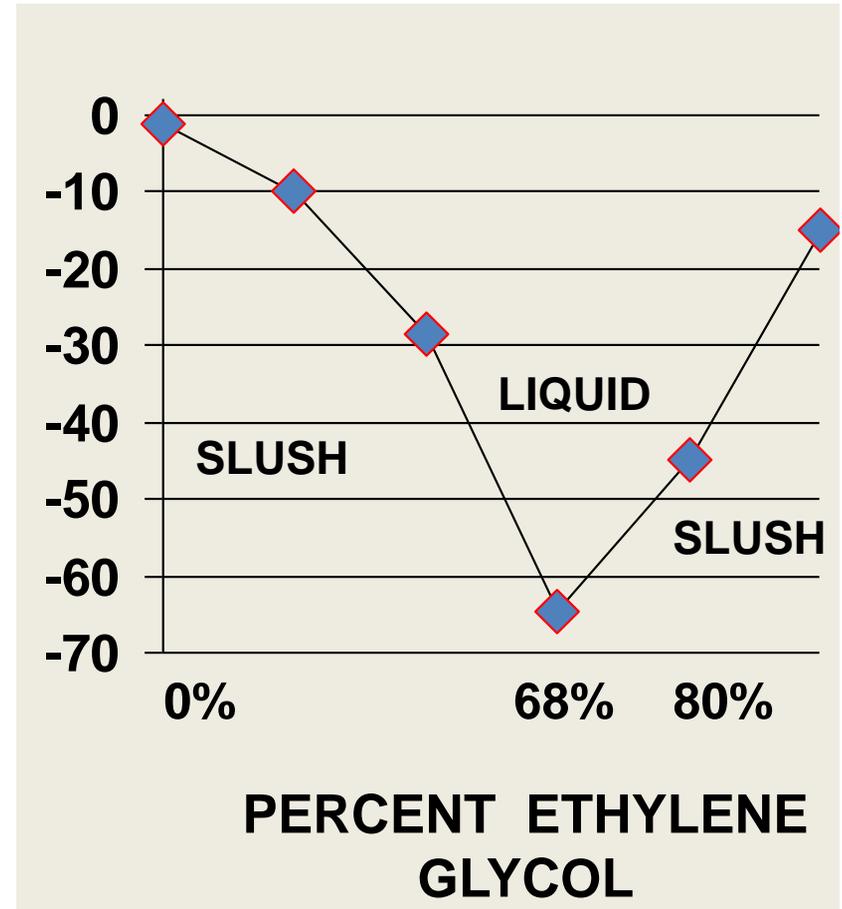
Antifreeze



Ethylene-Glycol must be mixed to a proportion of water to be effective; 68% antifreeze and 32% water is optimum.

Use of a block heater is important as ice crystals will begin to form at -40°F

Arctic type antifreeze protects to -90°F





Fuels



MOGAS is not affected significantly by low temp

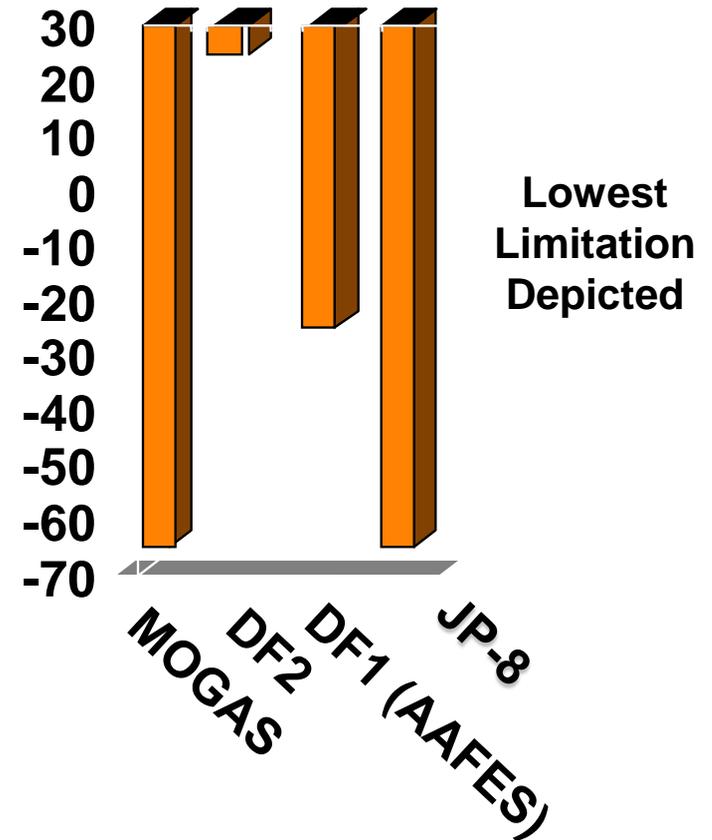
Diesel fuel is greatly changed by the formation of waxes

Condensation can contaminate fuel and turn into ice crystals

Additives can inhibit icing

The Army is going to a single fuel source; this fuel source is JP-8; JP-8 does not need additives above -53 F

Ether or similar spray can fluids are prohibited.





Lubricants



USARAK Regulation 750-4 governs what lubricants will be used in vehicles and weapons systems.



Lubricants



Engines will use Oil, Engine, Synthetic, OEA, 0W30 year round unless specified otherwise by manufacturer.

Transmissions, gear cases and hydraulic and power steering systems use OEA 0W30.

- **OEA is compatible with all transmission fluids including Dexron III.**
- **Can be mixed with other types of fluids.**

Caterpillar transmissions use 15W40

Allison (FMTV) transmissions use OEA only



Lubricants

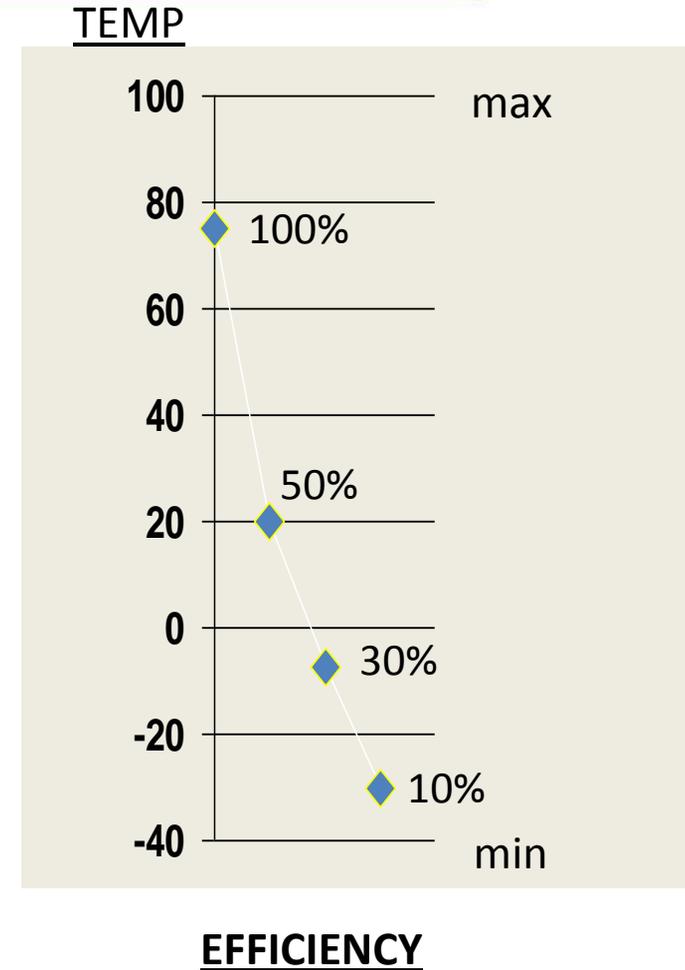


- **Manual transmissions, transfers, differentials and final drives use Oil, Gear 75/90 Synthetic**
- **HEMTT and HMMWV transfer cases use OEA**
- **Chassis and wheel bearing lubricant is Grease Automotive and Artillery (GAA)**



Vehicle Batteries

- Batteries are adversely affected by cold; as the temperature drops the current available decreases; at -40° F the power available is near zero
- A fully charged battery will not freeze; vehicle batteries do not receive an adequate charge unless warmed to 35° F
- Test batteries every three days; fill with 1.280 electrolyte for protection to -90° F
- Absorbent Glass Mat (AGM) batteries are generally maintenance free and are replacing older style storage batteries





Small Equipment Batteries



- **Keep small equipment batteries in interior pockets to help keep them warm.**
- **Nickel-cadmium type is very effective at low temperatures.**
- **Lithium sulfur dioxide batteries are recommended for cold weather. Handled as waste when depleted. TB 43-0134 for procedures.**



Generators



- **High failure rate often due to outdated Lubricant Orders**
- **Use clean fuel- contaminated fuel causes generator fuel line icing**
- **Check, drain, and clean filters daily and at shutdown**
- **Preheat and provide a small shelter so that the generator provides its own heat**
- **Proper grounding**



Preparation for Operation and Vehicle Winterization



- **Conduct PMCS using TM; see operation under other than usual conditions**
- **Wheel Bearings**
- **Hydraulic Braking Systems; check brake reservoirs; no special lubricant required**
- **Air Brake Systems – ensure valves are operational and that air tanks are drained to prevent condensation from forming and freezing. Check alcohol evaporator system. NMC 1 OCT-31 APR USARAK 750-4 C-1**
- **CTIS and air compressors – same check as Air Brake systems**
- **Steering Gear fluid reservoirs have correct fluid**



Preparation for Operation and Vehicle Winterization (cont.)



Shock Absorbers

Springs

Tires

Fire Extinguishers winterized

Oil Engine Arctic (OEA)

Belts and Hoses

Thermostats

Winter Fronts or radiator shutters

Vehicle personnel heaters mounted and operated

Tire chains are present USARAK 750-1 PG 14.



Vehicle Operation



- **Vehicles must be properly tuned prior to use**
- **Heat retention devices should be installed**
- **Allow engine to warm for at least 5 minutes prior to movement**
- **From -20°F to -60°F, periodic starting/movement may be necessary to keep vehicles operational**
- **Downgrade hoists and winch capacities by half**
- **Engine idle must be as indicated in TM to maintain battery charge**



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Effects of Cold on Weapons



Terminal Learning Objective



Action: Maintain weapons in cold weather

Condition: In temperatures of 32° F to -60 °F, given assigned weapon with technical manual.

Standard: Identify common problems with weapon systems that are caused by the cold weather. Take steps to reduce or eliminate problems caused by the cold before, during, and after operations.



Weapons: Common Problems and Solutions



Sluggishness:

- CLP (Cleaner, Lubricant Preservative) thickens in cold conditions and freezes at -35° F
- Lubricate with LAW (lubricating oil, weapon); if none available weapon should be fired dry
- Graphite lubricant is another option

Condensation:

- Occurs when weapons are brought into heated shelters; condensation freezes when the weapon is taken back into the cold
- **Store weapons outside**



Weapons: Common Problems and Solutions (cont.)



Fouling from Snow and Ice

- Use muzzle covers or improvise
- Use a de-icer for frozen weapons

Visibility

- Ice Fog at -30° F; difficult to observe strike of rounds; gives away position
- Frequent position changes may be needed or observer to spot/adjust rounds

Breakage and Malfunctions

- Extreme cold increases the chance of metal and/or plastic component failures
- ~~Slow firing rates to allow the weapon to warm gradually~~



Weapons: Common Problems and Solutions (cont.)



Deep snow will hamper emplacement.

Tripods may be mounted to Ahkio sleds

Plywood cutouts can be attached to tripod feet



Plywood cutouts on tripod feet





Machinegun Mounted in Sled





Weapons: Common Problems and Solutions (cont.)



- **Reduced Velocity and Range of Projectiles**
- **As temperature drops so does muzzle velocity and thus the range of projectiles**
- **Internal Ballistics**
- **External Ballistics**
- **Re-zero weapons in extreme cold conditions**



Rifles and Automatic Weapons



- **Re-zeroing required for all weapons systems**
- **High rate of breakage; require test firing prior to deployment.**
- **Units must carry extra parts**
- **Short recoil and buffer freezing causes malfunctions**
- **Begin with slow rate of fire**



MK-19



- **Use Lubricant, Weapon, Semi-Fluid (LSAT) or Grease, Molybdenum Disulfide (GMD) to -25° F.**
- **Below -25F use LAW**
- **Use cloth covers rather than plastics to protect the weapon from the elements**



Mortars

- **Temperature below 10°F, lube with LAW**
- **Wipe inside of bore dry before going out into the cold**
- **Cover cartridges**
- **Keep fire control instruments in their cases**
- **Cushion base plate**
- **Use anticontact gloves for dropped rounds**



Baseplate not cushioned before firing





Missile Systems



- **The TOW and Javelin can be used down to -25 F and can be stored down to -65**
- **Double the back-blast area of all missile systems**
- **The Javelin will drop when fired in the extreme cold; the weapon should not be fired from defilade or reverse slope positions**



Grenades and Demolitions



- **Smoke grenades should be deployed on a platform, hard ground or wired to a stake**
- **Grenades may stick to gloves/mittens if either item is wet**
- **C-4, detonation cord and time fuse may need to be re-warmed prior to use**
- **Double hangfire and misfire waiting times**



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