

Chapter 11

Weapons, Optics and Communications Equipment

11001. Importance of Care

The cold greatly affects the operation and employment of infantry weapons and causes equipment to malfunction. All Marines must be aware of these conditions to effectively employ and care for their weapons, ammunition, optics and communications equipment under winter conditions.

11002. Effects of Cold on Weapons

Problems with weapons in general in cold weather are summarized and discussed in the following paragraphs. For specific guidance, consult the appropriate technical manual.

- a. **Sluggishness.** Snow and ice in the operating mechanism or improper lubrication cause sluggishness. Cleaning must be done more often in cold and snow. Use a light coat of CLP only. CLP freezes at –35 degrees F. LSAT freezes at 0 degrees F. LAW (Lubricant, Arctic, Weapon) is effective from –65 degrees F to 0 degrees F. Lubricants become gummy as their freezing point nears. If you do not have the right lubricant for the temperature, fire the weapon dry.
- b. **Breakage and Malfunction.** Malfunctions occur from too much snow and ice in the weapon. Use gun covers, muzzle covers and improvised materials to cover every access point to the weapon. Ensure muzzle covers can be shot through for immediate action (i.e.- medical tape, plastic bag/cap, etc.). Keep magazines in magazine wells and rags in feed trays, etc. Breakage occurs in the first few rounds and at a higher rate in the cold. Fire slowly to allow the weapon to warm up (for automatic weapons: fire 3 single shots, then 3 short bursts, then normal bursts).
- c. **Condensation.** Condensation forms on weapons when they are taken from the cold into any type of heated shelter. This is called “sweating.” Weapons will continue to sweat for 1 hour. Weapons must be cleaned after an hour. If not, when the weapons are taken back out into the cold, the condensation freezes, forming a thin film of ice that can adversely affect the weapon’s operation. To prevent this problem, leave weapons outside and protected from falling/blowing snow but readily accessible. The vestibule of the ECW (Extreme Cold Weather) tent is ideal for this purpose. If the weapon is taken into a heated shelter, it can be wrapped in a jacket, etc. and placed near the floor to minimize sweating. These considerations apply to ammunition also.
- d. **Visibility.** Visibility is often reduced from falling or blowing snow, whiteouts, gray-outs, etc. Nights are longer in winter and also at higher latitudes. Ice fog can occur when weapons are fired at –35 degrees F and with 3mph wind or less. Ice fog is a thin cloud of ice crystals like a jet plane’s contrail that forms from the muzzle of the weapon to the point of impact with each round fired. It obscures the gun-target line and pinpoints your firing position. Prepare additional alternate/secondary positions to shift between and displace frequently. Aim at the origination point of the enemy’s ice fog line.
- e. **Emplacement.** In order to avoid sinking, sliding, bouncing or breaking, special techniques are used during the emplacement of crew-served weapons on snow, ice or frozen ground requires special techniques. These procedures are discussed under each weapon in paragraph 11003 “Problems and Solutions for Specific Weapons.”
- f. **Reduced Velocity and Range of Projectiles.** As a result of slower burning propellants in the cold, chamber pressure and muzzle velocity are reduced, thus decreasing the projectile’s range. Cold air is denser which increases the drag on projectiles during flight (which reduces range further). Test fire and BZO weapons frequently in the cold to maintain accuracy.

- g. Ammunition.** Cold weather can materially affect the accuracy of weapons and the performance of ammunition. Ammunition should be kept at the same temperature as the weapon; this can effectively be accomplished outside to prevent condensation. Ammunition should be stored 4” off the deck and remain sealed as long as possible in its original containers. Protect magazines, belts, etc. from snow and ice. Clean magazines of oil/lubricants and check frequently. Ammunition should not be lubricated. One foot of snow can absorb up to 80% of fragmentation. Deep, soft snow also increases the dud rate of point detonating fuses. For this reason, variable time/airburst is a preferred fuse in snow. Rocky or ice-covered terrain will increase the fragmentation effect.
- h. Backblast.** The cold increases the backblast effect of all recoilless-type weapons by a factor of three. Since backblast areas are tripled, all personnel must be instructed to plan for this hazard when fighting or training in the cold with recoilless-type weapons.
- i. Cold Weather Hand Wear.** When Marines wear mittens or heavy gloves, the speed of handling/firing weapons is reduced. However, this is not an excuse for not wearing hand protection. Under extreme cold, bare flesh freezes instantly to super-cooled metals. Thin contact gloves work best for dexterity in weapons handling. For extended operations in extreme cold, armorers should remove the trigger guards.
- j. Limited Technical Inspection (LTIs).** Ordnance mechanics and unit armorers will conduct LTIs on all weapons. Critical areas of inspection are:
- Make sure the trigger pull is heavy enough so that weapons will not accidentally discharge when handling with arctic mittens/gloves.
 - Replace loose fitting parts resulting from different rates of expansion/contraction.
 - Replace cracked or broken hand guards/stocks. Stress from the cold will rapidly make these parts unserviceable.
 - Check cracked/pitted artillery tubes. Cracks are unacceptable, pits acceptable.
 - Check the seals on all optical equipment; replace if cracked or torn to prevent fogging. Check nitrogen levels on all sights.
 - Check brake lines on all towed artillery pieces.
 - Check hoses on all sights to make sure there are no leaks.
- k. Cleaning.** Weapons exposed to extreme cold will malfunction if cleaned improperly.
- (1) Check small arms for excess oil/lubrication in the:
 - Chamber (causes rounds to stick and/or not fully chamber).
 - Gas system (causes sluggish operation and short recoil/runaway gun).
 - Bolt (freezes the firing pin solid)
 - Buffer (thickens and/or freezes, causing violent recoil or runaway gun).
 - (2) Guided missile systems require minimal care on ammunition, but check the trackers for:
 - Dirt/corrosion on the electrical connections (causes a bad connection and leads to a misfire).
 - Bent/loose mountings. Repair or replace. They are hard to connect and more difficult to work with in the cold when wearing mittens/gloves.
 - (3) Check mortars for oil/lubrication:
 - In the bore (thickens and causes feeding difficulties, even causing a round to lodge in the bore).
 - In the base plate socket (thickens and causes difficulty attaching the tube to the base plate).

- On the threads of the T&E (thickens and freezes, making the T&E inoperable).

(2) Check artillery weapons for:

- Dirt and excess grease in the racing teeth (causes difficulty in traverse and elevation).
- Excess oil/lubricants in breach blocks (freezes, causing operational difficulty/in-operability).
- Oil/grease in air tank bleed valves (clogs, makes brakes lock).
- Dirt/oil in firing locks (freezes the lock).

11003. Problems and Solutions for Specific Weapons

- a. **U.S. Pistol M9.** It is very difficult to handle with gloves/mittens, use contact gloves only. The magazine can freeze in the magazine well. The slide can freeze and cause a malfunction. Breakage of the firing pin and extractor/ejector can occur in extreme cold, carry spares.
- b. **M16A2/M-4 Carbine.** The M16A2 has a very close tolerance on its moving parts. It is vital that the M16A2 be cleaned of all oil and grease and then lubricated with a light coat of CLP/LAW. CLP is recommended for cleaning. But remember that it freezes at -35 degrees F (keep CLP next to body to keep it fluid and quickly wipe dry or clean and dry M16A2 in a heated shelter). LAW is recommended for lubrication (0 degrees to -65 degrees F) only. Ammunition should not be lubricated. The M16A2 performs well under extreme temperature conditions provided the magazines are free of firing residue. Be sure to clean the tops of magazines between firing. Care must be taken not to accidentally fire the weapon when inserting gloved fingers into the trigger guard area. Marines should always attempt to keep the weapon dry. Use muzzle covers and keep a magazine in the magazine well. Under combat conditions, it is necessary to cycle the weapon every 30 minutes to prevent freezing of functional parts. Additionally, to insure proper functioning, keep the insides of magazines and ammunition wiped dry; leave weapon outside when entering a heated shelter to prevent condensation. Additional measures necessary for reliable functioning are:
- (1) Tape the butt plate to prevent the vent hole in the upper butt plate screw from becoming plugged with snow/ice and to provide a non-slip surface for firing.
 - (2) Tape the stock with white medical tape to provide camouflage and prohibit the stock from falling apart if cracked/broken.
 - (3) Tape underneath the ejection port cover to eliminate the metallic sound of its opening.
 - (4) Tape the handguards to prevent snow from packing in around the barrel, to camouflage the weapon and to prevent it from pinching/falling apart if cracked/broken.
 - (5) Place white cloth medical tape, prophylactic, muzzle cap, etc. over the muzzle of the weapon to prevent snow/ice from plugging the bore. NOTE: Anything placed over the muzzle must be able to be fired through.
 - (6) Tape the pistol grip with the folding trigger guard in the lowered position to prevent it from closing, provide a non-slip grip and allow firing while wearing mittens/gloves.
- c. **M203 40mm Grenade Launcher.** The M203 is not susceptible to breakage in the cold. However, 12" of snow can reduce fragmentation effect up to 80% and increase the dud rate. Aim into trees for an airburst, if possible. Noticeable range reduction in cold weather occurs. Use a prophylactic, etc. for a muzzle cover. Protect sights from snow.
- d. **M249 SAW.** Use muzzle cover and protect feed tray with rag to keep snow out. Do not move with an ammunition belt in/exposed unless enemy contact is imminent. Keeping snow out of belted

ammunition is difficult. Attach ski pole baskets or an assault snowshoe to the bipod legs for flotation on snow or use a pack for expedient firing support.

- e. **AT-4.** Breakage can occur to the sights, cocking handle and rubber end caps. Snow/ice can get into the cocking handle, and must constantly be cleared. Backblast area is tripled. It is possible in extreme cold for the launch motor propellants to still be burning as it leaves the muzzle, because of the slower burn rate of propellants. Therefore, skin must be protected from exposure before firing (protect face, hands and eyes).
- f. **M153 SMAW.** Backblast area is tripled. Protect all exposed skin. Use gun covers. Protect spotting rifle from snow/ice. Below 32 degrees F, set the range selector switch to blue on the range drum (general range compensation only).
- g. **Grenades.** The casualty radius of fragmentation grenades is reduced in snow. Attach a stick or other device for flotation, but do NOT milk the fuse for an airburst. Wear dry contact gloves (wet ones can freeze to the grenade causing it to drop short). Do not wear thick mittens/gloves as it is easy to mishandle and drop the grenade. Make a platform for smoke grenades or set upside down in packed snow to prevent sinking and smoke absorption in snow (do not throw).
- h. **Mines.** Pressure activated mines can be neutralized by 6" of snow. Grease the fusewell and place in a plastic bag on platform (box, sticks, etc.). One night's snowfall can render a minefield ineffective. Wind can expose a minefield. Mines laid in the summer can be rendered ineffective by frozen ground in winter and reactivated by spring thaw. Burying in frozen ground can be impossible. Tilt-rod activated mines must be braced in snow and raised after fresh snowfall. Trip-wire activated mines must be raised after fresh snowfall. FASCAM will have many duds due to tilting/miss-orientation in snow.
- i. **Demolitions.** Military explosives and demolitions retain their effectiveness in the cold, but some of their handling properties change at low temperatures. C-4 can not be molded unless warmed. Both time fuse and det cord become stiff and can break. Time fuse and non-electric blasting caps are susceptible to condensation. Non-electric systems are preferred due to an increased amount of static electricity in cold, dry air. Misfire/hangfire times are doubled in cold. Demolitions are quite useful for breaking through frozen ground to dig fighting positions and to breach ice.
- j. **M240G Medium Machinegun.** There is a higher rate of breakage in all automatic weapons. Fire 3 rounds single shot, then 3 short bursts and then sustained rate to warm up and reduce breakage. Do not set a hot barrel on snow/ice as it will sink out of sight and ruin the temper of the barrel (or warp or crack it). Do not set on clothing, instead, use wood or metal buffing. Use gun covers and keep ammo in cans during movement and store outside. Firing platforms can be made from snow-filled sand bags, buffing a sled, using a-gunner's pack, attaching ski pole baskets or assault snowshoe to bipod legs, using MRE boxes or attaching 1 foot square plywood cut outs to tripod legs (imagination is the limit). Do not pull a sled with the machinegun mounted on top as it may cause the sled to roll over during movement. If ice fog conditions exist, dig 2 or 3 alternate positions. When engaging in ice fog, fire downwind to upwind, one side of traversing bar to next, FPL, from 6 o'clock to 12 o'clock on moving targets. Thoroughly dry T&E threads of all grease to prevent freezing and tape handwheels for improved grip.
- k. **M2 50cal Heavy Machinegun.** The M2 has little breakage; carry an extra firing pin and an extractor/ejector. Use all gun covers and sled cover when transporting. Use the gun cover on HMMWV during snowstorms. Do not transport at the ready-position in a sled. Do not fire from one sled. Two buffed sleds, sand bags filled with snow, thick plywood cut-outs, snow shoes (1 on each tripod foot), etc. can be used for tripod support. Use increased alternate positions in ice fog and engage as described above. Do not set hot barrel in snow; use full-length pad for barrel change. Use single shot/short burst/full burst warm-up technique. Keep ammo in cans until ready to engage. When away from the HMMWV, consider using a BV-206, or snowmobile pulling a gun sled as alternate methods. As a last resort, skiing/snowshoeing and pulling a sled can be done. However,

consider taking less guns and more ammunition in sleds unless the gun teams are augmented with additional people (Marines can only carry so much; guns that run out of ammo after just a few minutes are useless).

- l. Mk 19 MOD 3 40mm Heavy Machinegun.** Same emplacement considerations as M2 above. LSAT freezes at 0 degrees F, so change to LAW or graphite at 0 degrees F. Increased dud rate in snow. Fragmentation is significantly reduced in snow, up to 80% in 12". It is easy for snow to get into the large openings, extra care and cleaning is necessary. Always have a gun cover on when not firing.
- m. M3 Tripod Mount.** Clean the mount and lightly lubricate all external surfaces. Take particular care that the pintle bushing is clean and lightly lubed and that the pintle lock release cam is free from grit. The sleeve lock indexing levers and telescopic legs should be clean and lubed regularly. The pads can be reinforced with 1ft-square plywood pads or snowshoes wired on for flotation.
- n. M-63 Antiaircraft Mount.** A drop of CLP is sufficient on joints of firing grips, trigger control linkage, slides of trigger control mechanism, side plate trigger, side plate trigger cam, and pintle pivot bolts. Lightly oil the pintle. The traversing bearing should be lubed sparingly (monthly) using grease (automotive and artillery), injected by grease gun.
- o. M242 25mm Machinegun Gun.** Heavy grease must be used on the bolt to prevent dry bolt seizure.
- p. Mortars.** Breakage occurs in the base plate, yoke and firing pin. Aiming stakes will shift in snow from the sun warming the metal and melting the snow around it. Use the freeze (pour water around it) or chock (rocks, snow-filled sandbags, etc.) method with aiming stakes. Do not breathe on sights as this can cause fogging. Wear contact gloves and tape handwheels for improved grip. The fluid in the leveling vials can become sluggish in cold, increasing the time required to level bubbles. Airburst is preferred in snow; however, on frozen ground, ice or rocky terrain, fragmentation is increased. Use delay fuse for avalanche initiation. Store ammo outside 4-6" off the deck. Save increments for later use in the thawing of frozen ground (see emplacement below). Mobility: one sled per 60mm Mortar; HMMWV remains the 81mm prime mover (there is an 81mm mortar variant of the BV-206). Man-packing the 81mm mortar requires a lot of personnel in snow; consider the transport of less tubes and more ammo as a solution.
Emplacing the Mortar:
 - Dig to ground.
 - If ground is frozen, thaw, blast or buff. Thaw the ground with unused increments, blast through with demolitions or buff the base plate to prevent breakage, bouncing or sliding with snow-filled sandbags, tires, ration boxes or layers of pine bough and snow.
 - If unable to dig down (snow too deep), make a platform for support as above.
 - Imagination and experience are required to give accurate mortar fire in snow.
- q. Forward Observer.** Initially, increased ammo expenditure is the rule for adjustment in compartmented terrain (due to increased number of lost rounds and depth perception problems.) Communications relay sites will be needed. Sheaves open up on slopes (the steeper the slope, the more dispersed the sheaf). These conditions combine to suggest the need for more suppression and less destruction missions. Interdiction of MSR's is effective due to limited road networks and an abundance of natural choke points. Include altitude of target in call for fire. The FDC computers utilized in the U.S. make many corrections automatically that many potential enemies do not make or make by hand, which results in relatively slower or more inaccurate fire. These include temperature, humidity, barometric pressure, altitude of gun line and target, winds and slope angle.
- r. M47 Dragon.** The tracker (day or night) should not be taken abruptly from a cold to a warm area. Condensation induced by this action may cause clouding of optics and rusting of internal parts. Wearing the wool scarf over the nose and mouth may reduce fogging of sights. As with all recoilless weapons, backblast is tripled. Gunners must wear face, eye and hand protection. Snow glare through magnification is increased; wear sunglasses. Control wires become brittle and can break, causing

increased erratic-missile flight. There is an increased amount of large wet surfaces, which can cause increased erratic-missile flight. The Dragon is rated down to -25 degrees F (battery power may not be sufficient below -25F). Select a firing position with minimal snow to reduce launch signature (snow can be packed down or wetted to reduce signature). Emplacement/mobility of the Dragon is unchanged in snow. When firing in ice fog, fire offset to the downwind side of the target and count 1 second per 100m bringing it back to the target just before impact (the gun-target line will become too obscured to maintain a track if not fired offset with tamping of snow in front of- and behind the gun). For moving targets in ice fog, fire behind the vehicle's direction of movement and steadily bring to target as above (if fired in front of the vehicle, the track can be lost as the vehicle is eventually screened by the ice fog).

- s. **TOW II.** The TOW is rated down to -25 degrees F (there may not be sufficient battery power below -25F). Range is reduced to 3400m vice 3750m. The capstan can blowout at 10 degrees F. The TOW can be mounted on a BV-206, but is not recommended for sled transport. Protect face, eyes and hands while firing. Wear sunglasses for snow glare. Backblast area is tripled. Ice fog considerations are the same as for Dragon. The thermal sight works better in cold due to a larger contrast between background and target.
- t. **Predator.** Still under development at this time.
- u. **Javelin.** Range remains 2,000m. Can be fired down to -25 degrees F (design requirements, battery power may not be sufficient below -25F). Can be stored down to -50 degrees F. There is no bipod/tripod, so emplacement is not a problem. There is a "soft-launch" feature which will reduce target signature. However, still select a firing position with little snow or tamp snow to eliminate signature. The round is fire-and-forget, so there is no ice fog tracking problems. However, alternate firing positions will be needed. There is a slight initial drop on launch (until the flight motor kicks in) in cold, so do not fire from reverse slope/partial defilade positions in cold weather. Wear face, eye and hand protection. Backblast area is tripled.

11004. Effects of Cold on Optics

- a. **Lasers.** Laser capabilities are degraded by ice fog and blowing/falling snow as a result of refraction off snow and ice particles (the human eye sees farther in these conditions.) When clear, cold and dry - it is accurate to within 1m at 10,000m. There is an increased eye hazard from refraction off snow/ice, wear protection. False signals are possible with laser target designators due to refraction, or bouncing, of laser off snow/ice covered target (this can cause the guided bomb to impact 1,000's of meters from the target.)
- b. **AN-PVS 7.** Use the cold weather battery adapter and keep spare batteries next to the body. Use the de-misting shield. Plastic parts become brittle; use caution in handling. Keep in a case, protected from snow when not in use. Light amplification devices are more effective in snow cover due to increased ambient light reflection.
- c. **AN-PVS 4.** Use daylight cover on the move to protect from snow. Keep extra batteries next to the body. Light amplification devices are more effective in snow covered terrain.
- d. **Thermal Sights.** These sights work better in cold because of increased contrast between target and background. Heavy snow cover provides a uniform, clutter-free background. The human eye sees farther in falling/blowing snow than thermal. Snow and reflective insulation (like a space blanket) can be used for thermal camouflage. One foot of snow on a poncho provides overhead thermal cover for a position. Skiing or walking through snow will leave a thermal trail (duration can be minutes to hours depending on conditions and number of personnel).
- e. **Fogging.** Use care not to unnecessarily breathe on lenses and sights to avoid fogging of the glass. Gunners may wear facemasks to limit this occurrence.

11005. Effects of Cold on Ammunition

Weapons fired at temperatures below –35 degrees F with 3mph wind or less create ice fog contrails that pinpoint weapon locations and obscure vision on the gun-target line. Prepare and stock multiple weapons positions with ammunition. Use spotters to call corrections on the T/I phone for tanks in defensive positions.

- a. **Small Arms Ammunition.** The effect of cold on small arms ammunition is minimal. Velocity is lowered slightly which causes rounds to drop slightly. To overcome this:
 - Battle sight zero all weapons when they arrive in the cold weather operating area.
 - Range estimation will improve with experience. Use tracers if the tactical situation permits. Tracers provide the best method.
 - When firing uphill or downhill, estimate the horizontal distance for sight setting – not line of sight range. Effective field expedient methods are using map distance or to aim at 6 o'clock and adjust. CAUTION: laser range finders give line-of-sight. Trajectory is only affected by gravity over the horizontal distance (aiming points/data for uphill and downhill are the same.)
 - Increase ammunition allocation. Due to the effects of cold weather clothing, differences in range estimation, and the effect of cold on the human body, marksmanship will be reduced. Consequently, ammunition allocations must be increased.
- b. **Mortar Ammunition.** The fragmentation-absorbing effect of snow will decrease ammunition's effectiveness. To combat this:
 - Use variable time fuse for airburst over snow covered terrain.
 - Use delay fuse for avalanche initiation.
 - Use quick fuse on rocky or ice covered terrain.
 - Increase ammunition allocation. Dud rates will be much greater and must be planned for. The snow will also absorb up to 80% of fragmentation.
- c. **Artillery Ammunition.** Artillery ammunition will be affected by the cold with a result of 100m short for every 1,000m of range. While illumination rounds may malfunction and fail to open, those that are functional will be more effective because of reflection off the snowpack. Deep snow will absorb the bursting radius. When firing on frozen ground, rocks or ice, the effects of artillery ammunition will be enhanced.
- d. **Guided/Unguided Antitank Missiles.** All antitank missiles are designed to operate down to –25 degrees F. However, at lower temperatures their accuracy will decrease due to:
 - Effects of cold on the human's ability to function. The firing hand will feel numb due to the cold and heavy mittens/gloves. Practice while wearing gloves/mittens will help but not eliminate the problem.
 - Optical sights fog immediately if breathed on. Gunners should wear masks when firing (ECW mask, scarf, surgical mask, etc.).
 - Ice fog requires gunners to prepare multiple firing positions if temperatures drop below –25 degrees F. These positions should be 100m apart and pre-stocked with ammunition.
 - Runaway missiles can be caused by the wire guidance system shorting out, wet snow contacting the control wire or a broken wire from extreme cold.
 - Battery failure (causes misfires).

11006. Ammunition Storage

Ammunition storage areas should be sited to provide for all types of ammunition.

- a. **Protection from the Elements.** To protect ammunition from direct exposure to snow, leave it in shipping containers until it reaches its intended weapon systems. Dumps should include cover over ammunition and keep stored ammunition 4-6" off the deck.
- b. **Gunline Storage Sites.** The mishandling of ammunition or improper storage at the weapons site causes most misfires. Store ammunition at the same temperature as the gun and protect from the weather.
- c. **Freeze/Thaw Periods.** Awareness of the effects of probable freeze/thaw periods is essential for proper storage procedures. Keep ammunition out of low-lying areas. As a result of thawing and freezing, the area could flood during the day and freeze solid at night.

11007. Effects of Cold on Communications Equipment

Extreme cold affects communications equipment by reducing the efficiency of certain components and by making operating conditions particularly difficult. The need for regular and careful maintenance must therefore be combined with intelligent siting and a particularly high standard of operating. The most significant impact of cold on siting is the tendency to establish the antenna farm nearer to or within the battalion command post (Bn CP). At company level, radios are in the CP anyway so this is not a consideration. Locating the antenna farms near or within the Bn CP area reduces wire and cable problems, but will render the CP more vulnerable to direction finding. In addition, the CP site may not be a good position from which to communicate.

- a. **Condensation.** Condensation becomes a problem when temperatures fluctuate above and below freezing. Radio equipment is susceptible to the same dangers from condensation (sweating and freezing) as weapons, with the added problem of internal condensation (caused by battery heat). Internal condensation may take a long time to dry and may cause short circuits and damage. Anticipate that you will need additional radio equipment and additional time/labor to dry out equipment. Moisture from the breath freezes onto handsets and quickly coats them in ice; the button or switch may also become ice covered. Protect handsets by a cover which can be improvised from plastic battery bags and tape. Do not cover handsets with cloth that absorbs moisture and makes the problem worse. Do not place radios operated outside directly on ice or snow.
- b. **Radios.** Cold affects radios and their component parts in other ways. All flexible cables and some metal parts become brittle at low temperatures. Rough handling easily breaks power connections and cables. If a radio is dropped or jarred when very cold, it is far more likely to become damaged. All moving parts become stiff or may jam because of the varying contraction rates of different metallic parts and because of frozen condensation. Handle all cables carefully. Warm cables so they can be easily manipulated before you connect them, particularly between a vehicle and a dug in command post or between 2 vehicles.
- c. **Batteries.** All batteries give less power at low temperatures. The conventional dry cell battery loses efficiency very rapidly as the temperature drops. Store dry batteries at a temperature above 10 degrees F and gently warm them before use. Do not expose them to extreme cold until needed, and during use keep them as warm as possible. If an operator is going into a shelter for a short time to eat or rest, if possible, take the batteries with him and leave the radio outside to avoid unnecessary condensation. Take portable sets into shelters overnight. Avoid overheating lithium batteries; check with the communications officer on disposal of lithium batteries.
- d. **Vehicle-Mounted Radios.** Power for operating the vehicle-mounted sets is derived from the vehicle's battery/generating system. Place vehicles with radios in as warm a place as possible. Both the radios and the batteries should be well insulated on those sides that are against the cold metal of the vehicle body. To conserve battery life in the cold, it is necessary to operate the vehicle when operating the radio. Battery maintenance is important. Lead acid batteries should never be allowed to drop below 2/3 of full charge. They should not be charged at temperatures below 15 degrees F.

Check the specific gravity of batteries at least once a week using a view-type battery/antifreeze tester. Batteries with a specific gravity of less than 1.250 should be recharged.

- e. **Antennas.** Antennas may be difficult to erect in deep, soft snow and on frozen ground. They are also likely to become iced up. Antennas and particularly the wire supports should be jarred frequently to dislodge ice. Erect wire antennas so that wire is attached to one post by a weaker or thinner string that will break under built-up ice before the antenna breaks. Antennas can be anchored by trees, bushes, or a dead-man (buried log or rock). In an area where there are saplings, you can bend over one of the saplings, attach the antenna, and then release the sapling to give the antenna additional height.
- f. **Precipitation Static.** Precipitation static occurs when metal-antenna, high-powered radios and sensitive receivers are exposed to rain or wet snow. Highly charged pellets of snow striking and discharging on antennas cause this interference. Covering the antenna with polystyrene masking tape reduces this effect if there are no other adjacent metal surfaces (sides of a vehicle, etc.) against which the discharge can take place. Precipitation static is not apt to be a problem at battalion and below.
- g. **Grounding.** The amount of static electricity present makes grounding of radio equipment vital. Frozen ground is not a good conductor, and it is very difficult to drive in a grounding spike. The best ground is obtained by driving a spike through ice into water. The ground spike should be treated with salt, Epsom salt, or saltpeter.
- h. **Weatherproofing/Waterproofing.** By performing weatherproofing/waterproofing on communications equipment, reliability and dependability are enhanced. Conventional material for weatherproofing includes; multipurpose waterproofing covers and waterproofing tape. Field expedient materials include; poncho, raincoat, tarpaper, ammo cans, plastic bags, sheets of pliofilm, flexible plastics, etc. Any protection is better than no protection.
- i. **Operator Maintenance.** Because the polar regions are subject to disturbances that affect radio reception, it is very important to get the very best performance from radio sets. Operators must be experienced with their sets. In addition, they should:
 - (1) Keep radio equipment clean, dry, and warm (if possible).
 - (2) Handle the set and its ancillary equipment carefully, as most materials become fragile at low temperatures.
 - (3) Maintain the set and batteries regularly and meticulously and report any defects as soon as they become noticeable. The main points are:
 - Plugs and jacks are clean
 - Antenna connections are tight.
 - Insulators are dry and clean.
 - Snow and ice are removed.
 - Cable or internal connections are tight.
 - Motors and fans are turning freely.
 - Knobs and controls operate easily.
 - Dry batteries are fresh and kept warm.
 - Operating spares are on hand.
 - Breath shields are used on all handsets.