

APPENDIX D

EFFECTS OF COLD WEATHER ON WEAPONS

D-1. General

a. In cold areas many climatic conditions will greatly affect the operation and employment of infantry weapons. All individuals must be well aware of these conditions in order that they may properly handle and care for their weapons under adverse circumstances.

b. As a safety measure, extreme care must be exercised in touching cold weapons with bare flesh because the flesh may freeze to the metal. Gloves or the trigger finger mitten should always be worn when handling weapons during periods of extreme cold.

D-2. Factors Affecting Weapons

a. Sluggishness. A common problem is the sluggishness of the operation of the weapons in extreme cold. Normal lubricants thicken in low temperature and stoppage or sluggish action of firearms results. During the winter, weapons must be stripped completely and cleaned with a drycleaning solvent to remove all lubricants and rust prevention compounds. The prescribed application of lubrication oil, weapons (LOW) should then be made. These lubricants will provide proper lubrication during the winter and help minimize snow and ice from freezing on the weapons.

b. Breakages and Malfunctions. Another problem that faces the soldier in the areas of severe cold is a higher rate of breakage and malfunctions. These can also be attributed primarily to the cold, although snow in a weapon may cause stoppage and malfunctions. The tempered metal of automatic weapons, for example, will cool to a point where it cannot be touched by human flesh. This extreme cold makes the metal brittle. When the weapon is

fired at subzero temperatures, the temperature of the barrel and gun will rapidly rise to between 200° and 750°, depending upon the number of rounds fired. This again reduces the temper and, because the parts are working, breakages will occur early in the firing while the weapon is warming up. Many malfunctions also occur during this period due to the presence of ice or snow in the weapon or freezing of working parts. The weapons should first be fired at a slow rate of fire. Once the parts have warmed up, the rate of fire may be increased to the cyclic rate. One of the main problems is to insure that snow and ice do not get into the working parts, sights, or barrel. The weapon must be carefully handled during movement through the snow-covered woods, and especially under combat conditions in deep snow.

c. Condensation. Condensation forms on weapons when they are taken from the extreme cold into any type of heated shelter. This condensation is often referred to as "sweating." When the weapon is taken out into the cold air, the film of condensation freezes, especially in the internal parts, and stoppages and malfunctions result. When weapons are taken into heated shelter for cleaning purposes, "sweating" may continue for as long as 1 hour. Therefore, when time is available, wait 1 hour, remove all condensation, and then clean the weapon.

d. Visibility. A problem of visibility close to the ground occurs when a weapon with excessive muzzle blast is fired in temperatures below -37° F. As the round leaves the weapon, the water vapor in the air is crystallized, creating minute ice particles which produce ice fog. This fog will hang over the weapon and follow the path of the projectile, obscur-

ing the gunner's vision along his line of fire. If the air is still, the ice fog will remain for many minutes and hover in one place. Therefore, the weapon will have to be displaced to the right or left to again secure use of its sights if firing is to be continued.

e. Emplacement. Most crew-served infantry weapons need a natural "base" or gun platform so it may be fired accurately. In summer the ground provides a solid base and yet has enough resilience to act as a shock absorber. In winter the soft snow gives under the recoil of the gun. If the weapon is emplaced on the solid frozen ground, there is no "give" and all the shock of firing is absorbed by the weapon itself, resulting in breakage (para 6-7). Also the slippery surface of the frozen ground may allow the weapon to slide. If the snow is not too deep, and if time is available, tripods and baseplates should be dug into the ground or solidly positioned by expedient means to keep them from moving.

D-3. Cold Effects on Various Types of Weapons

a. Small Arms.

- (1) *Pistols.* Pistols cannot be fired while wearing the arctic mitten set. The firer must remove his mittens or use the lighter weight trigger finger mitten. The only other difficulty that may be encountered is the breakage of moving parts in extreme cold.
- (2) *Rifles.* Firing rifles will also necessitate the use of trigger finger mittens. This means that the firer cannot operate the weapon over a sustained period of time in extreme cold. All rifles will create ice fog. However, since the firer can readily move his position, this poses no serious problem. The main problem is that more malfunctions and breakages are caused in firing because of the cold or because of fouling of the weapon with ice or snow. Parts most subject to breakage are sears, firing pins, and operating rods-parts that are moving or affected by recoil. Malfunctions in automatic rifles may be

caused by snow or ice plugged magazines. Wingnuts on bipeds tend to freeze in position. To avoid this problem, apply LOW on parts concerned.

- (3) *Machineguns.* These weapons normally should be well lubricated with LOW because of their many moving parts. If LOW is not available, these weapons, when fired cold and dry, will have fewer malfunctions if fired at a slow rate of fire. Once the parts have warmed up, temperate zone lubricants can be applied and the rate of fire gradually increased. However, if temperate zone lubricants are used the gun must be kept warm. If it is allowed to become cold it will fail to operate upon resumption of firing. The gun should therefore be cleaned and fired dry and cold until it again warms up. MG's have a high rate of breakages and malfunctions because of the cold weather. Parts especially affected are the sear and bolt. Extra parts of this type must be carried by gun crews. One common malfunction, occurring early in firing is called short recoil (bolt does not recoil fully to the rear). Prescribed immediate action for the particular weapon should be applied. As the metal warms, the problem will diminish. A second malfunction is caused by freezing and hardening of buffers. This in turn causes great shock and rapid recoil, thereby increasing the cyclic rate. When this happens and the gun continues to fire, something has to give, and generally parts will break. Condensation will cause the freezing of parts as on most other weapons. Ice fog greatly impairs accurate firing, therefore, 2 to 3 alternate gun positions must be prepared.

b. Recoilless Rifle.

- (1) Propellants will tend to burn slower in the cold. Therefore, the firing data for temperate climates cannot be used and the weapon must be zeroed for the temperature in which it is

being fired. Once zeroed the weapons are again highly accurate. The rate of fire will be slower because of slow burning propellants. This is because after the round leaves the muzzle, burning gases remain in the barrel and the weapon cannot be reloaded until they burn out. The phenomenon is known as "afterburn." Gunners must exercise care to avoid premature explosion of the round in the weapon. A period of at least 60 seconds must elapse between firing and reloading.

- (2) One of the major problems in the firing of recoilless rifles is the formulation of ice fog. This will require frequent displacement of the weapon so that the gunner can regain visibility and also to avoid detection by the enemy.
- (3) Applicable training manuals for the recoilless rifle prescribe back blast danger areas for temperate zone firing. The danger areas must be tripled for safe operations in cold areas.
- (4) The Spotter-Tracer Rifle on the 106-mm Rifle creates problems because its trajectory and that of the recoilless round do not coincide. Metal parts of the spotter rifle are also subject to breakage. As in other weapons it is lubricated with LOW or fired dry.
- (5) Another phenomenon that occurs in extreme cold is deformity of the barrel because of solar radiation. This will happen if the weapon is foresighted, for example, prior to sunrise. If the sight reticle and the bore have been placed on the same target in the early morning hours, after the sun rises the bore may be pointing at one target and the sight reticle at the original one. The barrel has been actually bent because of the increase in temperature and thus the zero has been lost. After the weapon has been fired for several rounds, it is again boresighted and retains its accuracy. This condition concerns itself with gaining first round hits; the crew

must be aware of this and must know how to correct it. The gunner should not *rely entirely* on the firing tables in low temperatures, but should correct the data based upon experience and the best available data currently at hand.

c. Rocket Launchers. The main problem with rocket launchers is in the ammunition. The rocket has a burning propellant which moves it toward the target. This propellant because of the effect of the blast and its slow burning qualities in cold weather can be extremely dangerous in low temperatures. The gunner and loader can be burned and lacerated by particles of the burning propellant as the rocket leaves the muzzle of the launcher. The firing of these weapons (peacetime training) is normally restricted to temperatures above 20° F, but extreme caution should be exercised when firing at any temperature below freezing. Operating personnel must be equipped with face masks and gloves. Like the recoilless rifle, the back blast danger area must be tripled. The launchers have no emplacement problem, but will create ice fog and will have to be moved when the fog persists. The range is reduced because of slow burning propellants. The gunner will have to make his own firing tables and will probably have to sight high, especially at longer ranges.

d. Grenades.

- (1) *Handgrenades.* No particular problems exist in the use of handgrenades in extreme low temperatures with the exception that they lose much of their effectiveness when detonated under snow. The following are precautions necessary for throwing handgrenades by personnel wearing arctic handgear during extreme cold conditions.
 - (a) Handgear must be completely dry. Handling of snow and ice may result in grenades freezing to the wet handgear.
 - (b) Grenades must be held near the neck of the fuze to avoid slipping or turning of the grenades when safety pins are removed.

- (c) Right hand throwers must place the grenade so that the safety lever rests on the first knuckle of the thumb to insure a sensitive feeling of the safety lever.
- (d) Left handed throwers must place the grenade so that the safety lever rests between the first and second knuckles of the fingers, to insure a sensitive feeling of the safety lever and good access to the safety pin ring.
- (2) *Grenade launcher.* No particular problems exist in the operation of the 40mm grenade launcher at extreme low temperatures; however, like the handgrenade, the grenade itself will lose much of its effectiveness when detonated under snow and a higher proportion of duds will result. The launcher should be fired dry or lubricated lightly with LAW.

e. Tank Main Armament. These weapons have many of the problems of recoilless rifles. Breakage and malfunctions are few. The two primary problems are the formation of ice fog when the weapon is fired and distortion of the tube caused by solar radiation. The problems of lubrication and breakage are greatly diminished because of the fact that most of the working parts of the weapon are inclosed in a warmed turret. The major problem is the effect of temperature changes on the ammunition. Ammunition stored inside the turret will be warm and have the same general ballistic characteristics of ammunition fired in temperate climates. The weapon is generally zeroed with this warm ammunition. Other ammunition is stored outside the tank where the temperature is extremely cold. When this ammunition is fired, the powder will burn slowly and it will have completely different ballistic characteristics, thus rendering the initial zero useless. If possible, the ammunition brought in from the outside should be heated in the turret before firing. In a combat situation this is not practical because the ammunition may have to be used immediately. The gunner must have his own data for cold ammunition or be ready to hastily rezero the weapon. In either case he will have to make sight adjustments. There is

also the problem of snow particles being blown up in front of the sights by the muzzle blast and obscuring the visibility of the gunner.

f. Mortars. The matter of breakage in mortars is a minor one since there are few parts. However, firing pins often get brittle and break. The baseplate must be solidly positioned to prevent sliding. It may be necessary to dig into the ground to accomplish this. When the weapon is emplaced on frozen ground, the combination of the cold making the metal brittle and the tremendous shock that the baseplate receives when a round is fired, occasionally may cause the baseplate to crack. Frozen ground has no resiliency, and the baseplate and other bracing parts of the weapons absorb the entire shock of firing.

- (1) One field expedient that will reduce the possibility of a cracked baseplate is to place a brush matting under the baseplate. The matting should be thick enough to act as a shock absorber, but not so thick as to cause the baseplate to bounce out of its dug in position. Another method of positioning the weapon is to place bags of dry sand or snow beneath the baseplate. The sandbags will provide the weapon with a solid, yet resilient, shock absorbing base. An additional problem with the mortars is that they cannot be handled without touching bare metal as can other infantry weapons with wooden or plastic handles and stock. The crew must keep their gloves or mittens on and avoid touching the metal surface with bare flesh. There are practically no lubrication or ice fog problems with the mortars. Malfunctions are also quite infrequent.
- (2) The ammunition is affected by the cold in the same manner as the other types of ammunition. Firing tables may be utilized provided the proper range K's are established through experience. Applicable field manuals should be consulted for charge restrictions at low temperatures. The

VT-fuze type ammunition is considered the most effective mortar ammunition in the northern latitudes in the winter. Contact-detonated ammunition will penetrate the snow before exploding and much of its effective-

ness is lost and dissipated in the snow. A greater frequency of short rounds, as much as 1,000 to 1,400 meters short, (1,000 to 1,400 yds) may be experienced at low temperatures from the 4.2-inch mortar.