DIRECTORATE GENERAL BORDER ROADS

GENERAL MAINTENANCE INSTRUCTIONS

No.2

FROST PRECAUTIONS FOR VEHICLES AND ENGINEER EQUIPMENT

05 DECEMBER 1960

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Frost precautions for vehicles and Engineer Equipment

General

1. In order to prevent damage to engines of vehicles and equipment operating or stored under severe winter conditions, and in order to obtain easy starting and efficient operation under such conditions, the following instructions are laid down.

2. The frost precautions outlined in this Instruction will be ordered by CEs/DCEs under advice of SOI EME at their HQ when it is anticipated that weather conditions necessitate the same. They will be carried out by units under guidance of Task Force Workshops where necessary.

3. Reference will be made to hand books as to the frost precautions to be taken, and, methods to be adopted for easy starting and efficient operation. Where at variance with these instructions, the matter will be represented, action in the meanwhile being taken as per recommendations of the makers.

4. This Instruction covers the procedure to be adopted as regards :-

(a) Prevention of damage to water-cooled engineers
(b) Special lubrication aspects.
(c) Battery aspects.
(d) Points on easy starting of engines.

Water Cooled Engines

5. Water in the cooling systems of engines is likely to freeze over-night when engines are not running and cause cylinder blocks, radiators and water connections to crack. To obviate this therefore ;-

(a) Remove radiator cap.

(b) Drain water from cooling system by opening All drain cocks fitted. In some engines, separate drain cocks are fitted to radiators, pump and water-jacket, and some air compressors cooled by engine cooling water have separate drain cocks. (Yellow arrows painted on engine will aid drivers in ,finding drain cocks).

(c) Start and run the engine for **ONE** minute at a steady pace-then switch off.

(d) Cover engine with bonnet cover/muff.

6. If conditions do not permit of draining the cooling' system, then :-

(*a)* Cover engine with bonnet cover/muff.

(b) Run engine for 2 to 3 minutes every half hour or more depending on degree of frost.

7. To restart engine if water has been drained: -

(a) Close cocks, refill water and replace cap.

(b) Ease bearings by hand-cranking.

(c) Start engine preferably by hand-cranking.

(d) Remove bonnet cover after engine is warm.

8. NOTE :-If water is very cold, water may be externally warmed, or engine started dry and then system filled, immediately afterwards.

Use of Ethylene Glycol

9. Ethylene glycol will be used in all CI engines, and those spark ignition engines, that are required to be held in a state of readiness. The latter wilrb decided by CBs/DCEs Project.

10. The use of ethylene glycol as an anti-freeze mixture *is* made as follows :

(a) Drain cooling water completely.

(b) Refill with a solution of I lb of washing soda to a gallon of water.

(c) Run engine normally *for* one working day, then drain solution, and remove and clean drain cocks.

(d) Flush with clean water and replace drain cocks.

(e) Tighten all loose joints, and check cylinder head nuts *for* tightness.

(f) Refill cooling system with a solution of one part of ethylene glycol with two parts water.

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II. The solution of ethylene glycol will not be removed and *if* otherwise necessitated *for* repair purposes may be drained and the same refilled. Top up when necessary with the same solution, unless deficiency *is* due to evaporation only, in, which case water alone may be added.

12. The use of ethylene glycol, will be indicated by painting a red circle on the header-tank *(or* equivalent places).

Fire Trailer Pumps

13. Those fire trailer pumps where the main pump circulates water for the cooling system as well, wiI not be filled with ethylene glycol solution.

Other Anti-Freeze Solutions

14. Commercial anti-freeze solutions, that may be used in place of ethylene glycol, together with their , proportion to water, is as under :-

BRAND		% Proportion to water at				
		-5°C	-10°C	-15°C	-20°C	-30°C
(a)	Shell Anti Freeze'	15	23	29	35	45
(b)	Caltex PP Anti Freeze	12	20	27	34	44
(c)	Standard Vacuum Mobile Anti Freeze	-	22	29	36	45

Lubricants

I5. For easy starting and efficient lubrication at low temperatures the following Shell or equivalent lubricants are recommended. Where the latter are not available, their equivalents should be used.

	Grade	Characteristics	Application
	EIN " Engine Oils :		
(a)	Shell Rimula Oil 10 io W	Diesel engine oil for Caterpillar series III specification.	Caterpillar and International Harvester Diesel engines operating at sub-zero tem temperatures. For tempera-tures below -10°F dilute 9 parts of oil with 1 of grade 1 Kerosine.
(b)	Shell Rotella Oil Io-W	Heavy duty engine oil of lighter qualities than HD 30 and HD'20.	For diesel engine other than those at *(a)* above and petrol engines. Dilute as above for temperature below -10°F
	Gear Oils:		
(c)	Shell Spirax 80 EP	Extreme pressure gear oil with anti-foam additives.	For gear boxes operating at sub-zero temperatures , Where EP gear oil is to be used.
(d)	Shell Dentax *80*	Gear oil of the mineral type with anti-foam additives.	For gear boxes at sub-zero temperatures, where mineral EP gear oil is to be used.
	Hydraulic Oils:		
(e)	Shell Clavus Oil 17	Low pour-point oil	Hydraulic oil for sub-zero temperatures) Dilute with kerosine as for *(a)* above for temperatures below -10°F.
	Air Compressor Oils:		
(f)	Shell Tellus Oil 15	Oil containing anti-rust, anti- oxidant and and anti-foam additives	Rotaxary air-compressors at sub-zero temperatures.
	Greases:		
(g)	Shell Retinax A	Lithum base multi-purpose grease.	General lubrication. For temperature below -10°F thin with Clavus Oil 17

Batteries

16. Battery storage capacity falls appreciably with temperature and battery out-put may be reduced by *25%* to 50% with a temperature drop from 10^0C to -18^0 C. Even when correct lubricants are used, the cranking power required at -18^0C is twice that required at 26^0C.

l7. In general, the specific gravity of filling-in solutions and" also the specific gravity at full charge should be higher than for normal working conditions, and charging sections should note the specifications, laid down by various makers.

18. As the electrolyte of a fully discharged battery will freeze at -8°C and in a half charged battery at -26°C, care should be taken to ensure that batteries are always charged at extremely low temperature in the order of -30°C, batteries may be heated before starting by immersion in warm water up to an inch below the top if practicable

Starting and Running of Engines

19. Some general points on. the starting of engines are enumerated below :-

(a) Use the hand crank where possible to ease bearings and reciprocating parts.

(b) Keep engines protected by use of bonnet covers and muffs.

(c) To warm up engines, keep them running at a fast idle (800-900 RP.M.) and never race them until after they are sufficiently warm.

(d) All sudden heating and cooling is bad for engines, and may result in war page and cracks. To avoid this, idle engines for some time before switching off, after hard running.

(e) Never run a vehicle until after its engine has fully warmed up.

(f) A torch lamp may be utilised in the cases of some diesel equipment to aid starting by lightly. warming the air inlet pipe. In such cases, however, take care to avoid excessive heat at a particular point and also avoid risk of fire.

(g) Lastly study makers' manuals on the subject of cold weather starting and operation, and where in doubt consult the nearest workshops.

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