

Issue 551

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PS

October
1998

THE
PREVENTIVE
MAINTENANCE
MONTHLY

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They Rolled On
See Page 27

Coping with the Cold

It makes no difference if you're crossing the Sava River, standing guard at Panmunjom, or bivouacking near Fort Wainwright.

As the outside temperature goes down, the importance of preventive maintenance goes up... to the point where PM in extreme cold is probably more critical than PM in any other weather conditions anywhere.

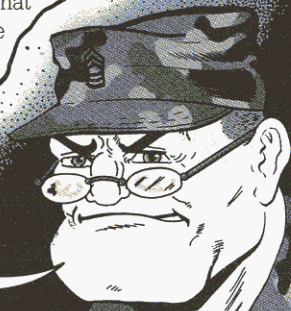
Your outfit's success—and your life—could depend on the strength of a sheet of canvas, or the reliability of a tent stove, or the power of a radio's battery. The only way to be sure of the canvas, the stove and the battery is to prepare.

A two-minute check or a quick PM chore done right can head off a repair job that could take hours when you're working on ice-cold metal and brittle lube lines with numb fingers.

It can be done. Units have proved time and again that heads-up planning, thorough preventive maintenance and solving little problems before they grow into big problems can add up to a successful operation in the worst weather you can imagine.

PM IS THE KEY. IT CAN BE YOUR TICKET TO SUCCESS IN THE COLDEST, NASTIEST WEATHER.

MAKE SURE YOU PUNCH THAT TICKET.





THE PREVENTIVE MAINTENANCE MONTHLY

TB 43-PS-551, The Preventive Maintenance Monthly, is an official publication of the Department of the Army, providing information for all soldiers assigned to combat and combat support units and all soldiers with unit maintenance and supply duties. All information published has been reviewed and approved by the agency responsible for the equipment, publication or policy discussed. Application of the information is optional with the user. Masculine pronouns may refer to both genders.

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You are invited to send PS your ideas for improving maintenance procedures, questions on maintenance and supply problems, and questions or comments on material published in PS. Just write to:

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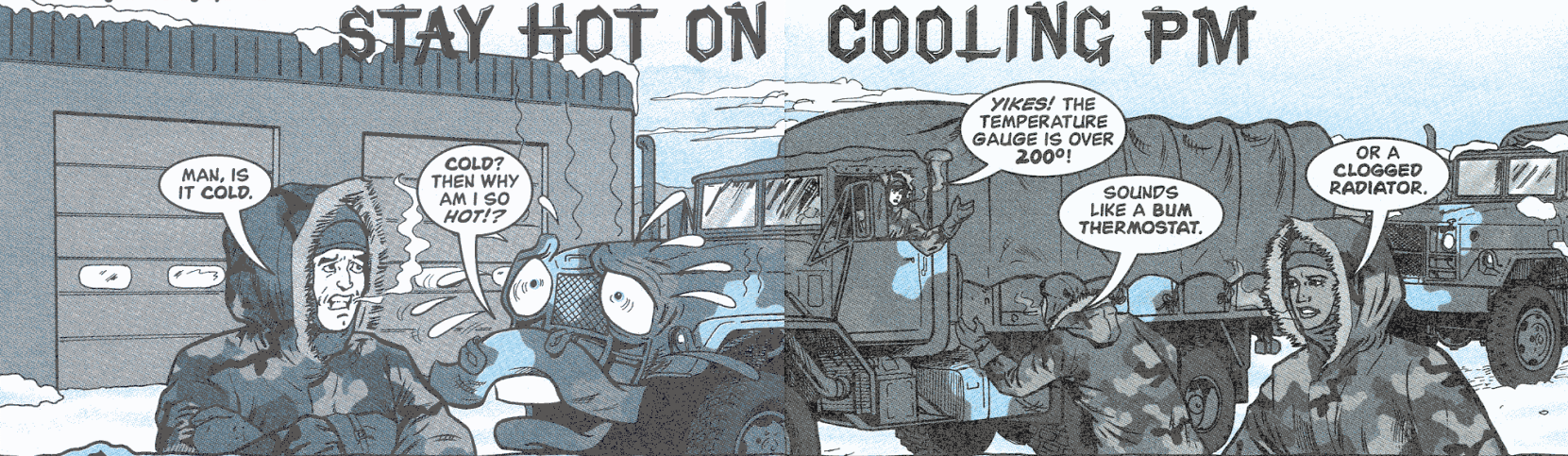
Joel B. Hudson
JOEL B. HUDSON

Administrative Assistant to the Secretary of the Army
05031

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STAY HOT ON COOLING PM



Operators, no matter how cold it is outside, your vehicle's cooling system should be able to reach 160° to 180°F.



I'M RIGHT WHERE I SHOULD BE.

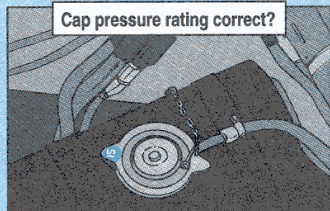
If yours won't, have the thermostat checked. It may be stuck open and need replacing.

A vehicle system that always runs at more than 200°F also needs attention. A bum thermostat, a clogged radiator, a bad radiator cap or filthy coolant may be the culprit. The engine's air flow may even be blocked.

Air-cooled systems don't need much attention. All they need is a good flow of air—meaning all the airflow shrouds must be in place.

To speed up heating in freezing weather, you can partially cover the air intake grills with canvas when starting the vehicle. Be sure to remove the cover after the engine reaches operating temperature.

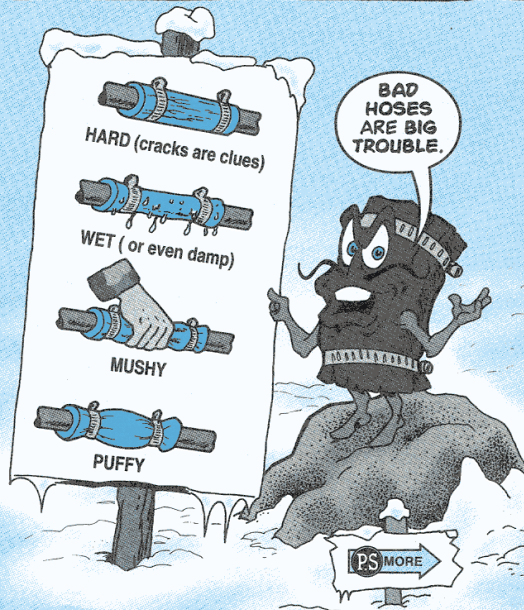
Look at the radiator cap. It should be the one your TM calls for. Just any



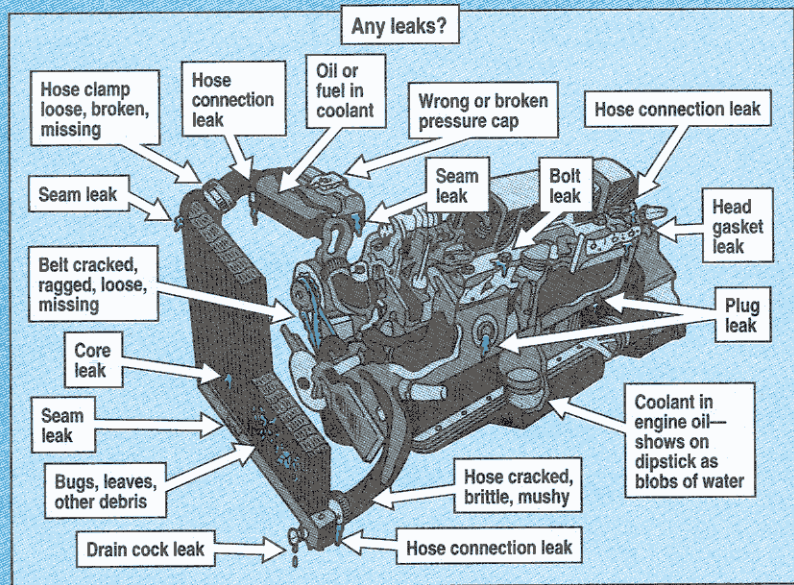
cap won't do. The pressure rating of the cap is vital. Too low lowers the boiling point of your coolant. Too high builds up pressure that'll pop radiator seams or blow hoses.

Hoses need to be touched as well as looked at. They must withstand heat, pressure and vibration. They're rubber, so they rot, harden and crack with age.

Report any bad hoses that you find. Check the radiator. Look for leaks on the top tank, front and back of the core, and bottom tank.



Leaks may not show up when your engine is cold. So, look for rust and odd-colored dribbles where coolant has leaked and dried.



Later, when you've got the engine running at operating temperature and pressure, check those places again for wet spots. Use a flashlight during both inspections.

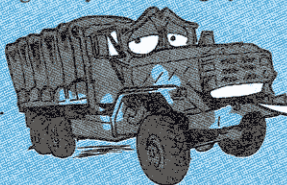
Finally, take the radiator cap off. If the cooling system is hot, open the filler cap slowly until all pressure is gone. Use a rag or glove to protect your bare hand from the hot cap.

The coolant should be at least over the top of the core. It should be almost clear—it'll be colored by the antifreeze.

If your coolant is muddy-looking or has bits of junk in it, your cooling system needs draining and flushing, maybe even cleaning. Report it.

If you see a rainbow of oil slime on top of the coolant, you've probably got a leak inside your engine. Exhaust gas or oil is getting into your cooling system. Pull the crankcase dipstick and check for water in the oil. Little blobs will show on the dipstick.

Water blobs on dipstick?



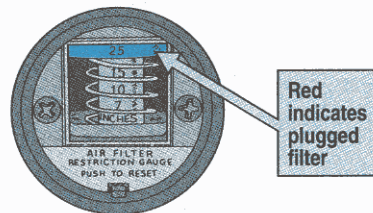
Water and Air Filters Don't Mix

Air filters don't move much air if ice and snow have turned them into air blocks.

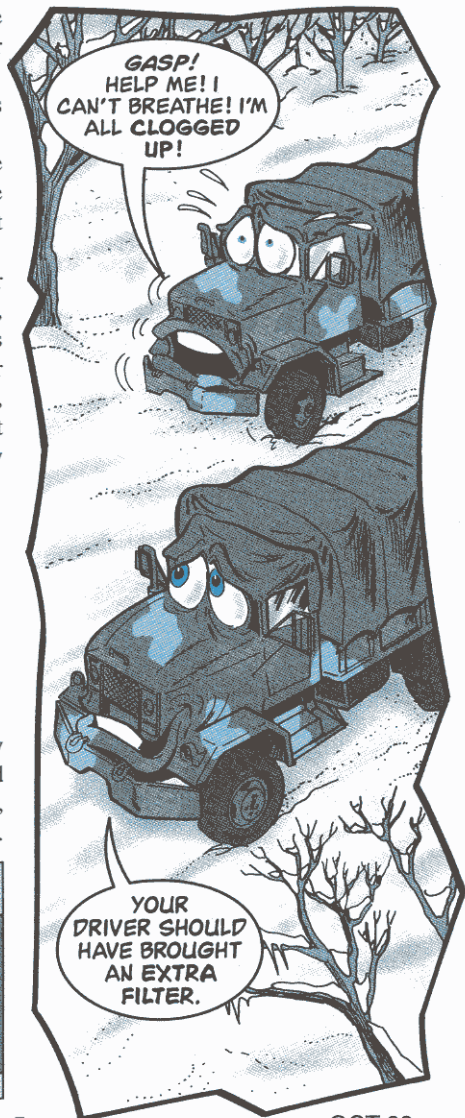
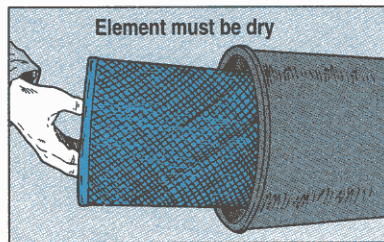
That can happen just as quickly as dirt clogs up a filter.

Moist air or snow sucked into the filter can freeze on the element. Once the element's coated with ice, air can't get through.

Keep an eye on your vehicle's air restriction indicator. On some vehicles, once the indicator shows red, the filter's plugged. On others, once a pointer reaches the red level on the indicator, the filter is plugged. Get the element cleaned and dried out, or get a new one.



Always keep snow cleared away from the air intake. In damp, cold weather, it's a good idea to have a clean, dry element on hand for a quick switch.



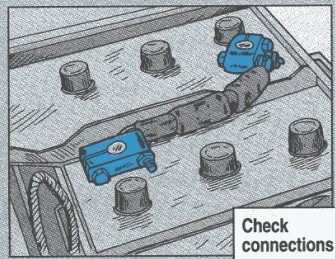
Make Slave Starts Safe Starts

I'M SO WEAK, I DON'T THINK I'VE GOT ANOTHER START LEFT IN ME!

DON'T WORRY—I'LL HELP YOU GET THE JUICE YOU NEED!

Never freeze frozen batteries. They can explode.

- Make sure all cables and terminals on the dead vehicle's batteries are tight and free of corrosion.



Check connections

Take weak batteries and freezing weather and you get vehicles that won't start. That often means you go for the slave cables.

Slaving correctly will keep your equipment on the job if you heed these precautions:

- Read the slave-starting steps in your vehicle's operating instructions.
- Never stand between vehicles being slaved and never position them nose-to-nose.
- Have your mechanic check that the electrolyte in all battery cells is above the plates and is **not** frozen.



Electrolyte level low



Electrolyte level OK

- Then do these things in this order:
1. Connect the slave cable to the dead vehicle's slave receptacle. The connection should be tight.
 2. If either vehicle has the old two-prong slave receptacle, use the NATO adapter. Put the adapter on the receptacle and then connect the cable.
 3. Push the slave cable connector into the slave receptacle on the live vehicle.
 4. Wait at least one minute, but no more than three, before trying to start the dead vehicle. This allows a trickle charge to warm up a dead battery before it gets the full jolt of slaving.
 5. Try to start the dead vehicle. Step on the clutch if the vehicle has one, to reduce engine drag.



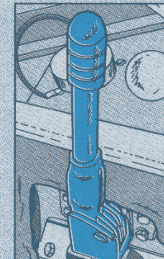
Slave adapter

Remember that you never run the starter for more than 30 seconds at a time. Let the starter cool off for two or three minutes between tries or you'll burn it up. If the vehicle won't start in three tries, give up. It has a bigger problem that your mechanic will have to solve.

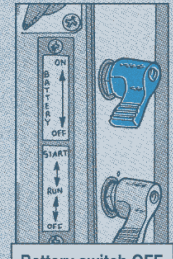
6. Keep the slave cable connected until the vehicle starts. Never unhook a slave cable while the starter is engaged, or you'll get arcing and burned-out cables and receptacles.

Once the slaved vehicle is started, pull the cable off that vehicle and then remove it from the other one. Let the engine run in the slaved vehicle at fast idle (1,000–1,200 rpm) for at least 20 minutes, or drive the vehicle about five miles to recharge the batteries.

- Set the parking brakes on both vehicles. Shift both transmissions to neutral. Keep the live vehicle's engine running at a fast idle.



Set parking brake



Battery switch OFF in dead vehicle

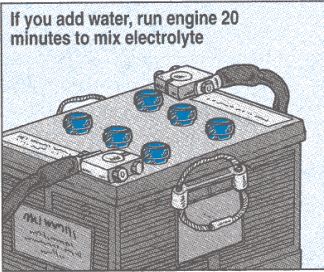
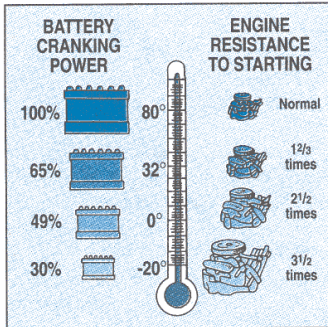
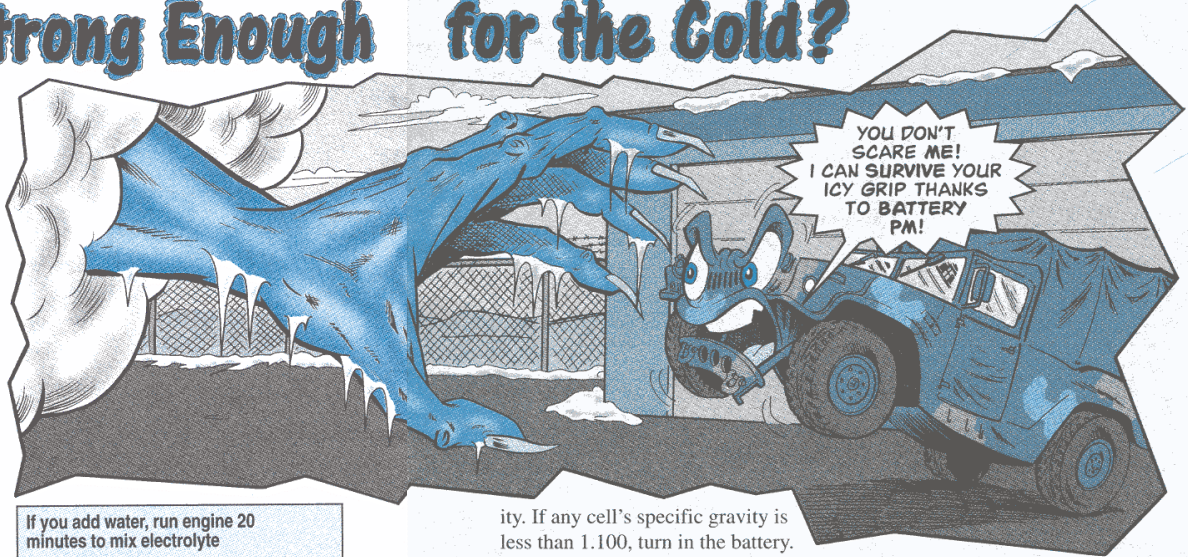
- Make sure the dead vehicle's battery switch is OFF to prevent arcing when you connect the slave cable.

Strong Enough for the Cold?

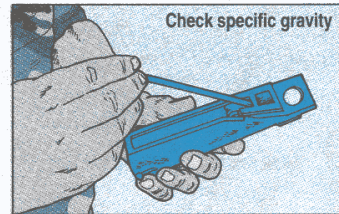
Guessing that your vehicle's batteries will survive winter weather can leave you stranded and very cold.

A weak battery has little chance of making it through the winter because even a good battery suffers. For instance:

- ▶ A fully charged battery loses a third of its cranking power at 32°F.
- ▶ At 0°F, it has less than half its power.
- ▶ At -20°F, it has only 30 percent of its power.



ity. If any cell's specific gravity is less than 1.100, turn in the battery. It'll freeze in cold weather. If there is a difference in specific gravity between any of the cells of more than 0.025, turn in the battery, too.



Keep Chains Tight

If your tire chains have slack in them after installing them, snug 'em up tight with rubber straps.

Here are three useful strap sizes:

NSN 5340-01-	Length (inches)	Stretch (inches)
029-9084	15	20-30
231-6015	20	26-42
029-9085	31	36-42

Your authority to order these items is Appendix A, CTA 50-970.

Here's how to determine if your batteries are strong enough for the cold.

- ▶ First, make sure you've got a copy of TM 9-6140-200-14, the battery bible.
- ▶ If you've just added distilled water to a battery, start the vehicle's engine and let it run at fast idle (1,000-1,200 rpm) for at least 20 minutes. That gives the charging system a chance to mix the water and electrolyte. If you don't let 'em

mix, you'll be testing water only. This mixing also helps keep water from freezing, saving cracked battery cases.

- ▶ Eyeball Chapter 3 of the battery pub for testing procedures. That means using the optical battery/antifreeze tester in the Common shop sets.
- ▶ Using the info in Para 3-6 of the TM, test the battery's specific grav-

If your unit uses a consignment system, turn the battery in as required.

Keep in mind that it's a good idea to run the specific gravity test on a "new" battery from supply, too. It could save you from being stranded—and cold.

Exceptions to the Rules

THE TM AND THE FM COVER TIRE CHAIN USE FOR MOST VEHICLES.

TRUE, BUT THERE ARE EXCEPTIONS!

Your vehicle's -10 TM is boss when it comes to tire chain use—unless there's no info in it. In that case, FM 21-305, Manual for the Wheeled Vehicle Driver, takes over to tell you when and how to use chains.

So, between your -10 and the FM, most situations and vehicles are covered, but here are some exceptions:

M939A1-series and M939A2-series 5-ton trucks—use chains on the intermediate axle. CTIS doesn't prohibit the use of chains on the intermediate axle.

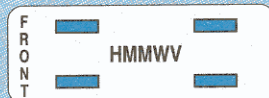
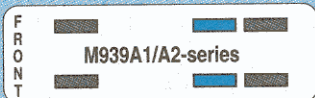
Palletized loading system (PLS)—use chains only on axles No. 3 and 4. Don't use chains when driving on hard surfaces, where there is no wheel slippage. Chains can cause severe component damage under "no-slip" conditions.

Also, set the CTIS to CROSS COUNTRY and proceed at 10 mph max on-highway or 15 mph off-highway.

HEMTT—use chains only on both rear axles. On M978 tankers, never use chains when driving on paved surfaces. They could cause sparks.

HMMWV—although Page 3-28 of TM 9-2320-280-10 says to use chains on all four wheels, you can also use chains on the front wheels as a set, or on the rear wheels as a set. It's OK to use chains on runflat tires, too.

Remember, too, that it's still important to select the right transfer range for driving conditions.



Drain Air Tanks Often



Wintertime is rough on truck air systems that don't get drained of water regularly, but it's murder on M915-series and M915A1 trucks.

If water freezes in these trucks, it causes not only the usual starting problems, but also gets into the air lines and ends up in the transmission control group. That causes the transmission to grind and miss gears.

Draining the air tank just once may not get all the moisture out. To make sure, after you've drained it, let the air pressure build up. Then drain the tank again. Keep doing this procedure until no more water comes out of the tank.

Drain the air tanks every day the temperature is below freezing. Be sure to service the air dryer filter, too.

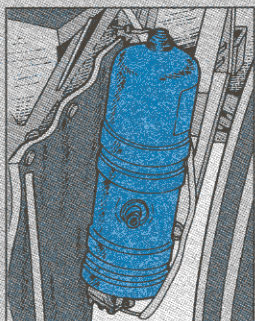
M915, M915A1, HEMTT ...

Keeping the Air Dry

Servicing the air dryer on your big trucks can be expensive, but it doesn't have to be.

Some mechanics clean the dryer by replacing the entire cartridge, which is not necessary and costs a bunch of money.

But, smart mechanics know to clean the dryer by using desiccant parts kit, NSN 4440-01-081-1391. The kit has everything you need, including instructions, to make the cartridge as good as new.



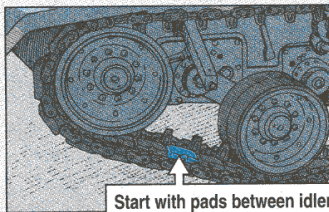
Kit makes dryer good as new

Cleats Keep You Moving



Here's how to install 'em:

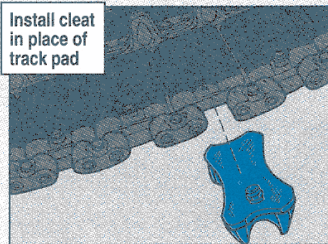
1. Clean the left and right track to remove all dirt and debris.
2. Position the first track shoe between the compensating idler wheel and the number one roadwheel.



Start with pads between idler wheel and No. 1 roadwheel

3. Remove the track shoe's inner and outer pad and self-locking nut.
4. Install two ice cleats on the track shoe in place of the removed pads.

Install cleat in place of track pad



5. Lock each cleat in place with a new self-locking nut, NSN 5310-01-102-2711. Torque the nuts to 260-300 lb-ft.
6. Follow steps 3-5 for the track on the other side of the tank.
7. Move the tank forward to position the next track shoe needing cleats.

For best performance, put a set of cleats on every fifth shoe. That means you'll need a total of 64 cleats for each vehicle (32 per track).

Remember, these cleats are for **T158 track only**. They will not work with T156 track.

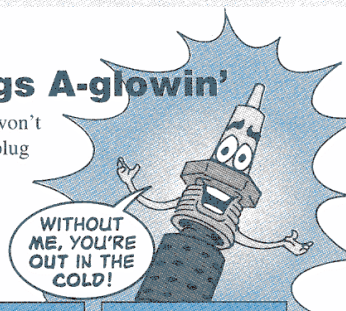
Combat Vehicles . . .

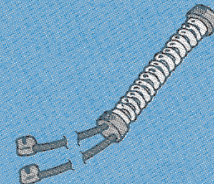
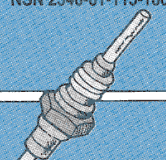
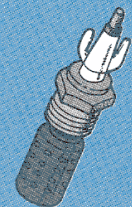

Keep Heater Plugs A-glowin'

Got a combat vehicle personnel heater that won't work? Chances are that a bad igniter or glow plug is the problem.

Replace the bad ones now and you won't have to suffer through the cold this winter.

Here's a handy chart that matches an igniter or glow plug to its heater model:



<p>Stewart-Warner 10560C, 10560G, 10560M, 10560M24B1 NSN 4520-00-217-5782</p> 	<p>Hupp MF510B NSN 2540-01-115-1805</p> 	<p>ESPAR V75 NSN 2540-12-167-3599</p> 
	<p>Hupp MF60A-24V, MF60B-24V, MF510C NSN 2540-01-167-7248</p> 	

Take the Heat Off

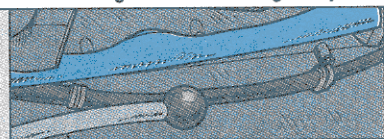


Mechanics, the air coming out of the driver's personnel heater outlet is very hot. In fact, it's hot enough to melt the plastic covering on the front service brake control assembly cable in his M1-series tank.

Protect the assembly by insulating the cable. Here's how:

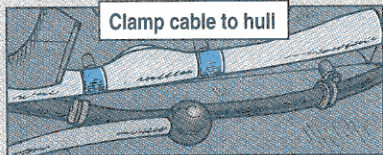
1. Remove the two clamps holding the cable to the hull.
2. Cut off a 15-in piece of insulation sleeving, NSN 5640-01-100-0444, and slit it open lengthwise. Put the sleeving over the cable and slide it against the jamnut.

Slide sleeving over cable and against jamnut



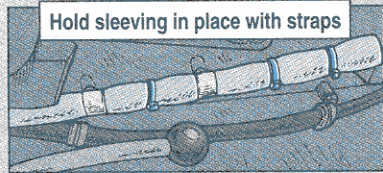
3. Slip two new clamps, NSN 5340-00-912-8871, over the insulated cable and reattach it to the hull.

Clamp cable to hull

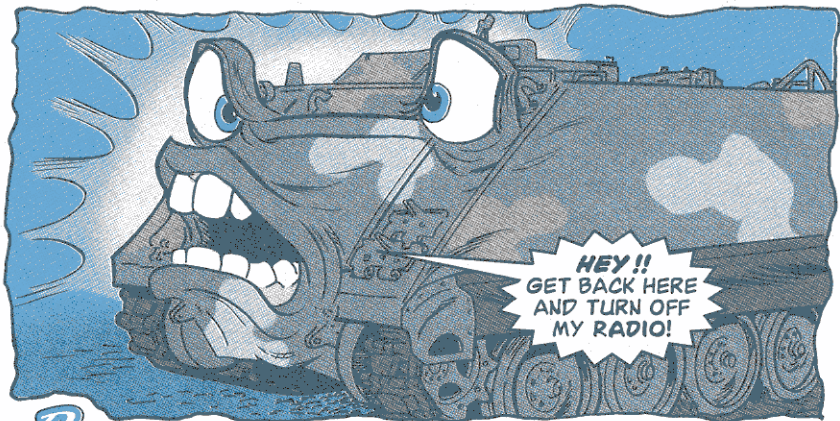


4. Tighten the sleeving in place with straps, NSN 5975-00-074-2072. One strap goes between the two clamps. The other two go forward of the clamps.

Hold sleeving in place with straps

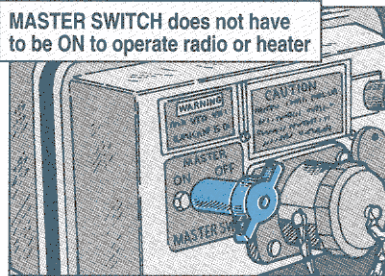


Switch OFF Master Switch



Drivers, if you need to use the personnel heater or radio in your M113A3 carrier, don't turn the MASTER SWITCH to ON. Both work just fine with the switch OFF.

MASTER SWITCH does not have to be ON to operate radio or heater



Leaving the switch ON keeps the steering lockout solenoid energized. If it's on long enough, the solenoid will burn out and deadline your vehicle.

Just make sure you remember to turn the radio off when you finish. If it's still on when you start the engine, you'll end up with a fried radio.

M113-Series FOV, M109A2-A5s, M992s, M578s ...

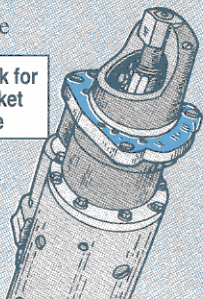
Gasket Keeps Starter Warm

Starters that freeze up when the thermometer starts falling are probably the victims of missing gaskets, mechanics.

With no gasket to stop it, water seeps inside the starter. The water freezes and the starter is stopped cold.

The next time you pull the powerpack, look for the starter gasket, NSN 5330-00-980-1546. No gasket? Install one.

Look for gasket here



Screen Out Debris

SEEMS LIKE
I'M HAVING TO
VACUUM ALL THE
TIME!

I'VE GOT
TWO WORDS
FOR YOU,
PAL. **INLET
SCREEN!**

Dear Half-Mast,

We've had all kinds of problems with dirt, paper, and other junk getting into the exhaust fan of the personnel heater in our MLRS. Then the fan jams and the heater is damaged.

Vacuumping around the fan helps some, but sooner or later the fan jams up again.

How can we stop this damage?

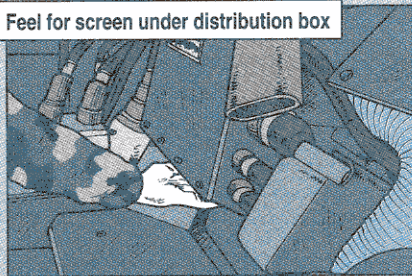
SFC W.D.R.

Dear Sergeant W.D.R.,

The most likely cause of your problem is a missing air inlet screen, NSN 2510-01-264-0153.

The screen is part of the personnel heater system, so it's supposed to be removed and kept whenever the cab distribution box is sent in for repairs. If the box is turned in with the screen attached, you won't get the screen back.

Feel for screen under distribution box



With no screen, junk gets sucked into the air inlet where it eventually jams the exhaust fan.

Reach under the cab distribution box and feel for the screen. If it's not there, get your mechanic to order a new one.

Half-Mast

Keep Heater Clean and Running

Dear Editor,

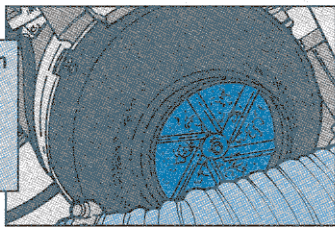
The more you use your MLRS' personnel heater, the more dust and dirt are going to build up inside.

Enough debris will lock up the exhaust fan. That burns out the heater's 6.3-amp fuse and shuts down the heater. Not knowing what's wrong, most operators send the heater in for repairs.

But our fix is simple and easy:

1. Remove the dryer vent hose inlet.
2. Vacuum the accumulated dirt and dust around the fan.

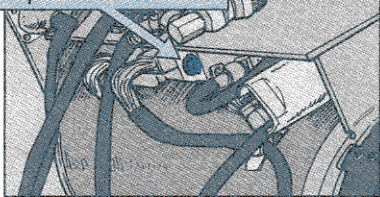
Clean dust and dirt from fan



3. Turn the fan back and forth to loosen dirt at the base of the fan and vacuum again.

4. Replace the 6.3-amp fuse, NSN 5920-01-308-6297.

Replace burned out fuse



Of course, you can usually prevent the problem altogether by cleaning the fan at the end of winter and again before the cold weather season starts.

SSG Christopher Lenning
2/4th FA
Ft Sill, OK

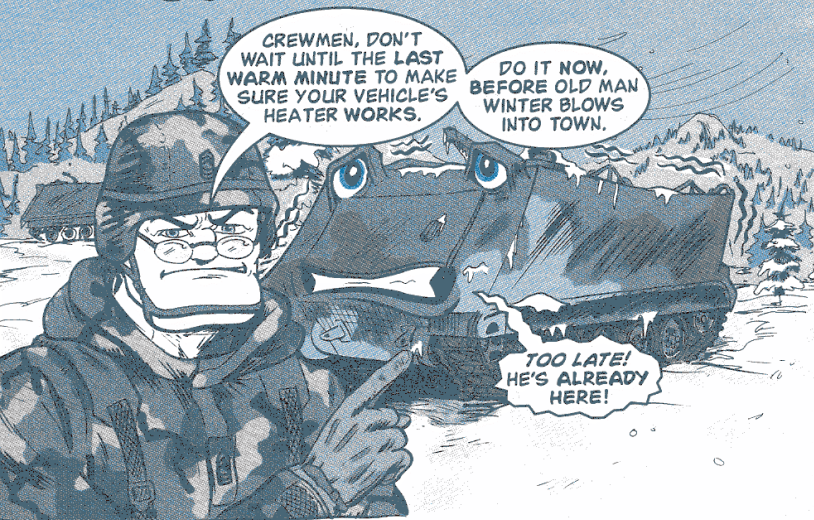
FROM THE DESK OF THE Editor 

A cool solution to a potentially hot problem! Good job!

W-WHAT A TIME FOR YOUR H-HEATER TO CONK OUT.

A LITTLE CLEANING AND A NEW FUSE WILL MAKE MY HEATER AS GOOD AS NEW.

Some Like It Hot!



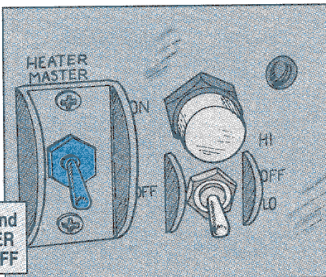
CREWMEN, DON'T WAIT UNTIL THE LAST WARM MINUTE TO MAKE SURE YOUR VEHICLE'S HEATER WORKS.

DO IT NOW, BEFORE OLD MAN WINTER BLOWS INTO TOWN.

TOO LATE! HE'S ALREADY HERE!

Stewart-Warner Heaters

If you have a Stewart-Warner heater, Model 10560G, C or M, and it doesn't start, cycle the start switch two minutes on, 10 seconds off. This keeps the ignition control from getting too hot while you try to get it working.



If heater doesn't start, try a second and third time by cycling HEATER MASTER switch one minute ON, 10 seconds OFF

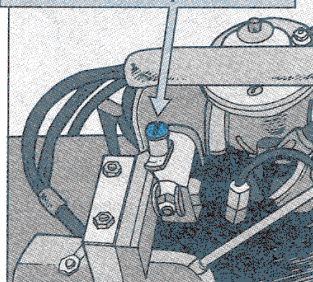
If the heater won't start after the third try, go through the troubleshooting procedures in your -10 TM. Still won't start? Have your mechanic take a look at it.

Mechanics, voltage to the igniter is very important. It should register 10 volts. Visible hot spots and uneven coil spacing are signs of a defective igniter. Replace it. If you still don't get the required 10 volts, let support check it out.

While the cover is off, you should check the flame detector switch. On newly installed Stewart-Warners, the flame detector switch may need adjusting. Here's how:

Make sure the heater is off and cool, then turn the adjustment screw counterclockwise part way. Slowly turn it until the switch clicks. When you hear the click, turn the screw one-half turn clockwise. Apply sealant, NSN 8040-00-225-4548, around the screw head to keep it from moving.

Put sealant around adjustment screw



Hupp Heaters

Your Hupp MF510B, MF510C, MF60A-24V and MF60B-24V heaters start differently than the Stewart-Warners.

Let your Hupp heater stay in the start mode for four minutes. That's how long it takes a Hupp igniter to get hot.

If the heater doesn't start right away, wait 15 minutes before trying a restart. That's a long time to wait when you're cold, but any sooner and you risk flooding the heater.

If the heater still refuses to start, get your mechanic to check the incoming voltage. It should read between 24-28 volts.

Heater Shutdown

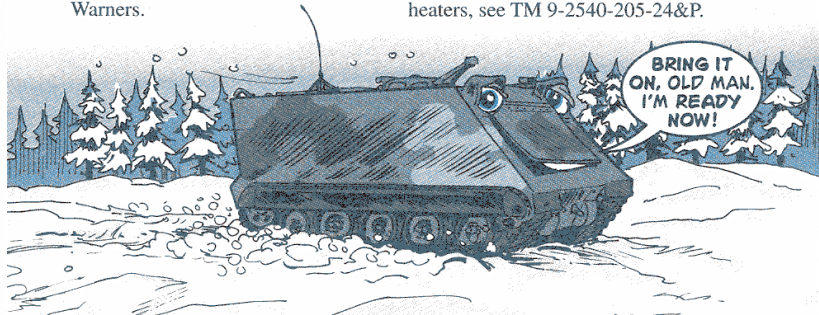
Take the time to shut down your heater the right way, or the next time you need it you'll be left out in the cold.

Once you've got the heater started, let it run for at least five minutes or the heater may flood. Then you won't be able to start it again for a long time.

Give your heater a chance to purge itself at shutdown. Some vehicles have electric circuitry that lets the heaters run and purge themselves even with the master switch OFF. Others have to run until purging is finished before you kill the master switch.

Guessing will only get you into trouble, so check out your vehicle's -10 TM and follow instructions.

For more information on personnel heaters, see TM 9-2540-205-24&P.



BRING IT ON, OLD MAN, I'M READY NOW!

Can't Stand the Heat? Divert It!

Dear Editor,

During cold weather, the personnel heater in the back of our M88A1 recovery vehicle puts out a LOT of heat. Unfortunately, crewmen in the back of the vehicle cook while the driver freezes.

When you're in the field, you have to constantly start and shut off the heater in order to regulate the temperature. That's hard on the heater.

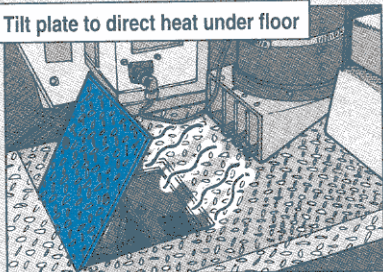
We've solved the problem by opening the oil reservoir access plate and leaning it at an angle toward the heater vent.

The heat is diverted under the floor plates where it warms the entire vehicle by slowly radiating upward through the steel floor plates. That keeps everyone comfortable in the front and back of the vehicle.

There's another benefit, too. In extremely cold temperatures, the heat under the floor plates helps keep the hydraulic system warm. It's ready to go whenever you need it.

SPC Michael Nelson
2/34th AR
Ft Riley, KS

Tilt plate to direct heat under floor

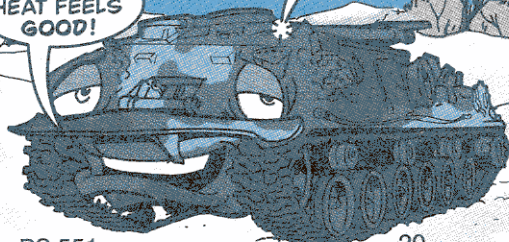


FROM THE DESK OF THE Editor

Now that's an idea we can all warm up to! Make sure you run the vent blower whenever the heater is on, though. That prevents a buildup of carbon monoxide in the vehicle.

AHHH. THAT HEAT FEELS GOOD!

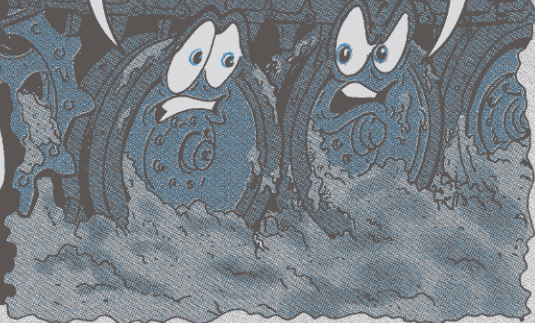
YOU GOT THAT RIGHT.



Stuck in the MUD?

THEY SHOULD'VE
CLEANED THIS MUD OUT
BEFORE LEAVING US
FOR THE NIGHT.

YEAH, I BET
THEY GET TO TAKE
A BATH BEFORE
BEDTIME.



Mud can fool you, even in cold weather. During the day it may be soft and wet, but at night it can freeze as hard as concrete. A vehicle sitting in the mud in the afternoon could be frozen in its tracks the next morning.

Don't think you can rock your vehicle loose, either. You'll end up with broken track, snapped drive sprocket teeth, bad U-joints and a vehicle that's still stuck.

The time to prevent the problem is before the sun goes down.

Park your vehicle on high ground if possible. The water drains downhill so the mud won't be quite as deep.

Avoid parking in deep ruts worn by other vehicles. Some are deep enough to bottom out your vehicle's hull. Leave it there and you may not be moving until spring.

Use a shovel to scoop out mud that's collected on and between roadwheels and drive sprockets. If the mud's not there, it can't freeze.

SUSV...

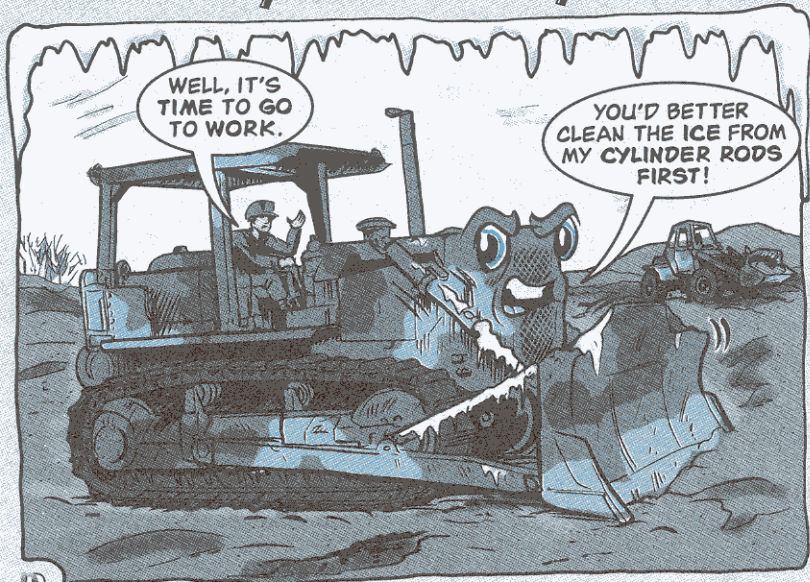
Cold Weather Crack-up

You'll do almost anything to keep warm while driving your SUSV in sub-zero temperatures. That includes spending your own money to buy a portable, battery-operated heater.

But there's a problem with those heaters. If you put 'em in the wrong place—like on the console beside you—the hot air that keeps you warm also blows on the windshield. And when hot air meets extremely cold glass...*crack!*

Next time during start-up, let your SUSV heat up the way it's supposed to—gradually—with the cab heater.

Clean Hydraulic Cylinders



Before you operate your construction equipment's hydraulics in cold weather, eyeball the cylinder rods for ice build-up.

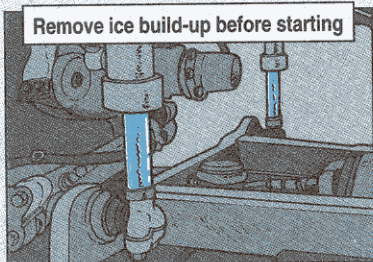
Ice on the rods will scrape or cut seals when the rod is moved. Damaged seals lead to fluid leaks, which lead to NMC equipment. If you find any ice, get rid of it.

Some Exercise Needed

Another rod saver, no matter what the weather, is to exercise the cylinders weekly. This fights rust by spreading a thin coat of oil on the rod. Rust, like ice build-up, will scrape and cut the rod's seal.

If you can't exercise the hydraulics, smear a light coat of GAA on the cylinder rods.

If the equipment will sit longer than a month, coat the polished cylinder rod with grease, then wrap it with waterproof paper, NSN 8135-00-753-4662. Hold the paper in place with preservation sealing tape, NSN 7510-00-852-8180.



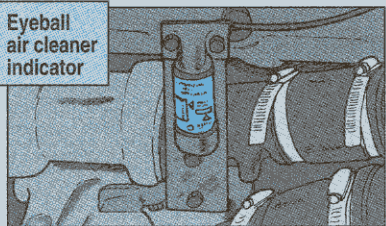
Clean and Tight

Operators, clean and tight are the words when it comes to your dozer's air filter and batteries.

Air Filter Brush-off

A clean air filter element is crucial because unfiltered air shortens engine life. Especially in dusty areas, keep an eye on the air cleaner indicator below the air cleaner canister. If the indicator moves from green to red, pop the canister's lid and pull out the air filters. The secondary filter is inside the primary filter.

**Eyeball
air cleaner
indicator**



Tap each filter with the heel of your hand to loosen dirt or sand. Then shake it and tap some more. This will knock enough junk out of the filter so you can continue work until a mechanic can clean or replace the filter. Never bang the filter on a rock or hard surface.



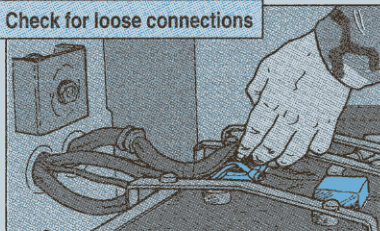
Tap filter to remove dirt

Battery Clamp Lowdown

All that bouncing around in the rough stuff loosens battery clamps. A loose connection keeps your battery from charging. It also keeps your dozer from starting.

Play it safe. Remove the battery box's cover. Eyeball the tightness of the clamps on the terminal. If they're loose, tell your mechanic.

Check for loose connections



Always make sure the battery indicator or ammeter gauge is in the CHARGE range before you go, too. If it isn't, don't go.

**CLEAN
FILTERS AND TIGHT
BATTERY CLAMPS KEEP
ME MISSION
READY!**



WINTER PM TIPS

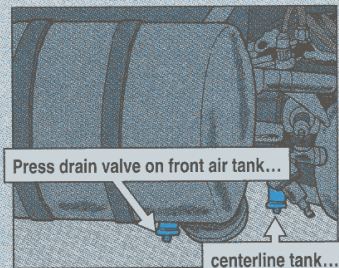


Operators, pulling routine maintenance on your SEE just won't hack it in the winter.

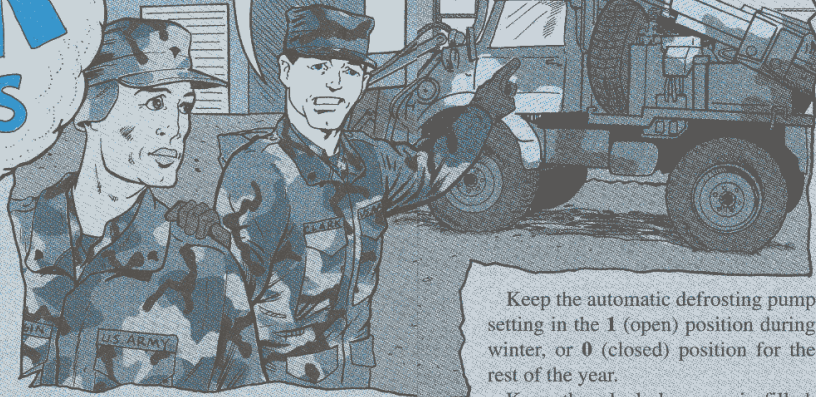
Here are a few PM tips to keep in mind when temperatures start to fall.

The swing between cold and warm temperatures increases condensation in the SEE's air brake system. That condensation leads to corrosion and brake failure, and in sub-freezing weather, clogged air lines.

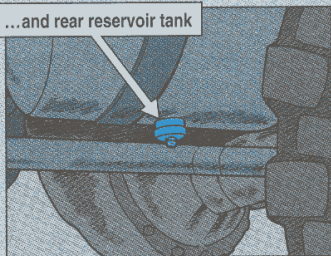
Get the water out by pressing the drain valves on the front air tank, the centerline tank and the rear reservoir tank each day.



HEY, WHERE ARE YOU GOING? WE'VE GOT MORE PM TO DO. THIS SEE WON'T MAKE IT THROUGH THE WINTER WITH JUST ROUTINE MAINTENANCE.



...and rear reservoir tank

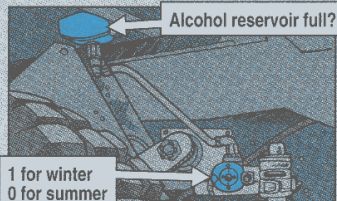


Antifreeze Unit Ready?

Make sure the SEE's compressed air system antifreeze unit is set for the season. The antifreeze unit injects alcohol into the air brake system to keep water from freezing in the brake lines.

Keep the automatic defrosting pump setting in the 1 (open) position during winter, or 0 (closed) position for the rest of the year.

Keep the alcohol reservoir filled, even in summer, so dirt and dust can't get into the system.

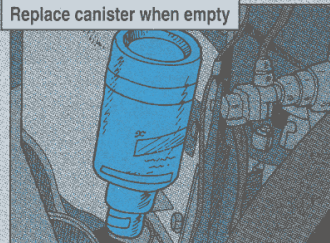


Rough Start?

Your SEE may be hard to start when the temperature drops below freezing. The cold weather starter system has a fuel canister that automatically injects ether into the engine when you push the cold start button.

If your SEE is hard to start, chances are the ether canister is empty. Have your mechanic replace it.

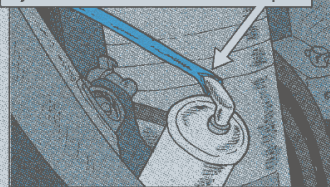
Replace canister when empty



No Washer Fluid?

The rubber hose that attaches to the washer fluid reservoir can crack or split from harsh temperatures and vibration. Then the windshield washer pump sucks in air instead of fluid, and you can't clean the windshield.

Eyeball rubber hose for cracks or splits



Your mechanic can fix the problem like this:

Eyeball the hose where it attaches to the nipple on the windshield washer jar. That's where the hose usually splits. Snip off a half inch of the hose and push it back in place.

If you're not getting washer fluid, have your mechanic check the pump or replace the rubber hose with NSN 4720-01-242-4535.

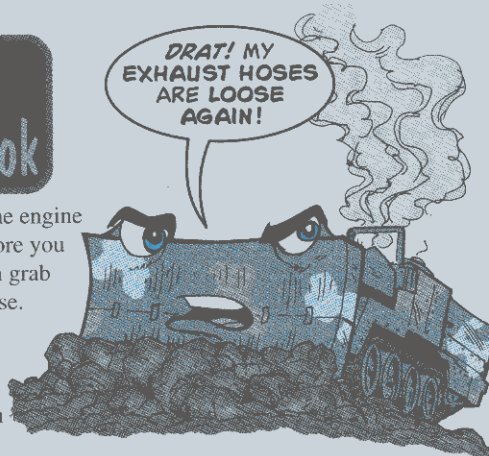
Exhaust Clamp Needs Second Look

Mechanics, when you're working in the engine compartment, make one last check before you climb out. Make sure they're cool, then grab both exhaust hoses to see if they're loose. In particular, give the exhaust clamps a slight tug.

If they're loose, snug up the hose and tighten the clamps. Replace broken clamps with NSN 5340-01-183-6863.

A busted clamp on the top exhaust hose means that engine exhaust can vent directly onto the batteries, cooking them. It also lets exhaust fumes into the operator's compartment.

A busted clamp on the lower hose lets exhaust blow directly onto the battery cable. Heat from the exhaust will melt and destroy the cable. Then your ACE won't start.



Look and feel for loose clamps

Down with Ether Cans!



perators, vehicles are often a headache to start in cold weather. Some engines have starting aids built right in, others don't.

Whether yours does or doesn't, never use spray-can ether.

Ether cracks pistons, bends rods and ruins heads.

When your vehicle has a hard time starting, here's what you should do:

- ❖ Troubleshoot your vehicle according to its TM.
- ❖ Go easy on the vehicle's starter. Never keep the starter engaged for more 10-15 seconds.
- ❖ Have your mechanic replace the ether canister, if it has one. The canister may be empty.
- ❖ If your vehicle won't start in three tries, call in your mechanic to find out what's wrong.

AT THE BASTOGNE HISTORICAL CENTER...

THEY ROLLED OIL...



IT SURE IS COLD HERE IN BELGIUM.

YEAH, I'M FREEZING!

IT WAS COLD THEN TOO—BITTERLY COLD—AND IT SEEMED LIKE THE SNOW WOULD NEVER STOP.

OCT 98

I'VE NEVER BEEN SO COLD.

OR SO HUNGRY. I'D TRADE MY BOOTS FOR A THICK, JUICY STEAK.

DID YOU HEAR WHAT THE OLD MAN TOLD 'EM WHEN THEY ASKED US TO SURRENDER?

YEAH, "NUTS".

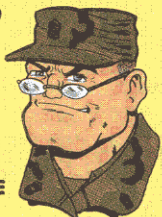
I WOULD HAVE LOVED TO HAVE HEARD THAT!

SPEAKING OF NUTS, I'D TRADE MY BOOTS...

"YEP, GENERAL MCAULIFFE TOLD THE ENEMY, "NUTS!" AND OUR BOYS HELD OUT WHILE LIEUTENANT GENERAL GEORGE PATTON JR. AND THE U.S. THIRD ARMY RACED TO RESCUE THEM. TO DO THE JOB, THE THIRD ARMY NEEDED BRAVE MEN AND A GALLANT LEADER, BUT THEY ALSO NEEDED TOPNOTCH P.M. WHEN WE LANDED AT NORMANDY IN JUNE OF '44, ONE VEHICLE CAME ASHORE FOR EVERY FIVE MEN."



"NOW, SEVEN MONTHS LATER, AS PATTON'S ARMY RUSHED TO BASTOGNE, IT WAS PM THAT KEPT MANY OF THEM, LIKE THE 2 1/2-TON TRUCK, STILL ROLLING. THE DEUCE-AND-A-HALF WAS A WORKHORSE, BUT BAD WEATHER AND ROUGH TERRAIN CAN BREAK THE BACK OF THE BEST HORSE. TOO MANY EXHAUST MANIFOLDS WERE CRACKING, SO GOOD PM CALLED FOR CONSTANTLY CHECKING THE STUDS, CLAMPS AND WASHERS. HARDWARE THAT WAS TOO TIGHT WOULD CAUSE MANIFOLD CRACKS; HARDWARE THAT WAS TOO LOOSE DID THE SAME. JUST RIGHT WAS ALL THAT WOULD WORK."



ARE WE
READY TO
ROLL?

WE CHECKED ALL
THE BOLTS, CLAMPS, AND
STUDS. THEY'RE READY TO
GO, AND SO ARE WE.

"REAR BRAKE LINES WERE ANOTHER PROBLEM. ICE AND FROZEN MUD CUT THEM LIKE A HOT KNIFE THROUGH SOFT BUTTER. PREVENTIVE MAINTENANCE CALLED FOR BOLTING A METAL SHIELD TO THE WHEEL BACKING PLATE AND THEN WELDING IT TO THE SPRING GUIDE-BRACKET. THE BRAKE LINES HELD AND THE TRUCKS ROLLED ON."

HOW'S THAT BRAKE LINE SHIELD WORKING OUT?

GREAT! THE LINES ARE PROTECTED FROM ICE AND FROZEN MUD.

"TAIL PIPES WERE CLOGGING. NOW THAT WAS A REAL MESS. PM CAME TO THE RESCUE AND CONE-SHAPED EXTENSIONS WERE ADDED."

AS SOON AS I BOLT ON THIS TAILPIPE EXTENSION, WE'LL BE READY TO ROLL.

AS YOU KNOW, YOU WON'T MOVE FAR IN THE COLD WITHOUT A RADIATOR. AND TOO MANY OF THOSE WERE SHAKING LOOSE. GOOD PM MEANT CHECKING THE HOLD-DOWN BOLTS OFTEN.

WHAT ABOUT THE JEEP?

"WE ALL KNOW THE 1/4-TON TRUCK WAS THERE. THAT JEEP DID ITS JOB AND DID IT WELL. BUT THE COLD AND STRESS MADE FOR METAL FATIGUE. FRAMES WERE CRACKING AND BREAKING AROUND THE REAR SPRING HANGER. SO THE BOYS GRABBED SOME P.M AND MADE A REINFORCEMENT PLATE TO KNOCK OUT THE TROUBLE. SNOW, SLUSH AND WATER WERE GETTING INTO THE AIR CLEANER TUBE. P.M AND SOME WATERPROOF TAPE SOLVED THAT PROBLEM. AND THE QUARTER-TONS ROLLED ON."



WE'VE GOT A CRACK IN THE FRAME NEAR THE REAR SPRING HANGER.

IS THERE ANY WAY TO REINFORCE IT?

YOU MEAN LIKE A PLATE?

WORKS FOR ME.

I'LL GET RIGHT ON IT.

I'LL GET SOME WATERPROOF TAPE AND TAKE CARE OF THE AIR CLEANER.

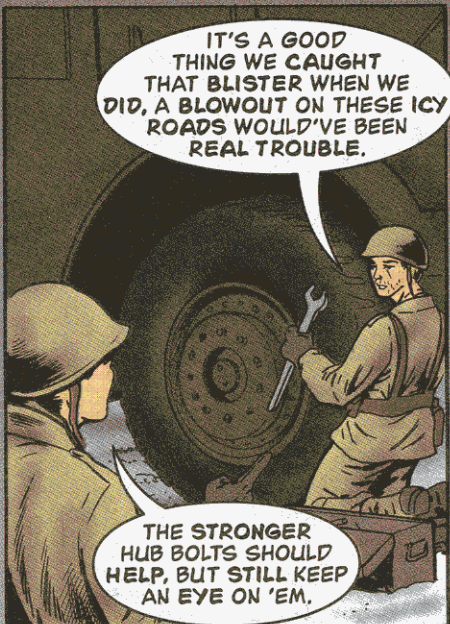
"OF COURSE, THERE WERE THE TANKS—MEDIUM, LIGHT AND HEAVY. THE ONE THAT CARRIED THE BRUNT OF THE FIGHT WAS THE M4 MEDIUM. WE CALLED IT THE SHERMAN. THE BOYS KNEW THAT IN THIS KIND OF WEATHER AND THIS KIND OF TERRAIN THEY HAD TO KEEP ITS PROPELLER SHAFT U-JOINT LUBED, TO MAKE SURE THE CARBURETOR DIRT GUARD WAS IN GOOD SHAPE, AND THAT THE DRAIN PLUG SCREENS WERE CLEAN. THEY REGULARLY CHECKED THE SHOCKS, KEPT THEIR AIR CLEANERS CLEAN AND KEPT OIL FILTERS ON HAND."





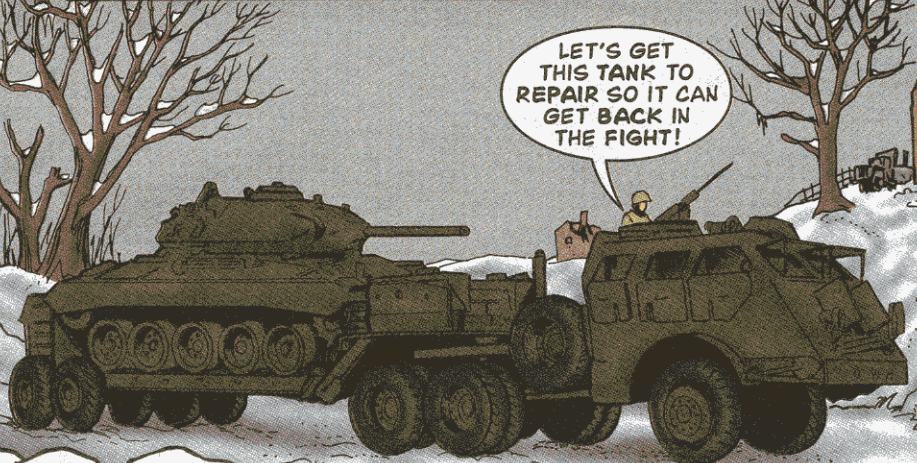
"AND WITH TANKS, THEY NEEDED THE M25 TANK TRANSPORTER. BUT THERE WAS A PROBLEM WITH THE WHEEL RING STUDS

SHEARING OFF. VETERANS SAID THERE WAS NOTHING FUNNY ABOUT WATCHING A 40-TON TANK TRANSPORTER TOTING A MEDIUM TANK DOWN AN ICE-ENCRUSTED ROAD WHEN A FEW OF THE STUDS LET GO AND THE TIRE TUBE CREPT OUT LIKE A BLISTER AND SUDDENLY EXPLODED. PM DEMANDED A FIX AND THE BOYS ANSWERED THE CALL. THEY GRABBED THE STRONGER HUB BOLT FROM THE 1 1/2-TON DODGE, FOUND THAT IT FIT AND WORKED, AND ROLLED ON."



IT'S A GOOD THING WE CAUGHT THAT BLISTER WHEN WE DID, A BLOWOUT ON THESE ICY ROADS WOULD'VE BEEN REAL TROUBLE.

THE STRONGER HUB BOLTS SHOULD HELP, BUT STILL KEEP AN EYE ON 'EM.



LET'S GET THIS TANK TO REPAIR SO IT CAN GET BACK IN THE FIGHT!

"PM, PATTON AND LOTS OF GUTS GAVE THE GUYS AT BASTOGNE A GOOD NEW YEAR'S."

R-R-R-R-R-R-R-R-R-R-R



"IN 1944, MAJOR GENERAL A. C. GILLEM, JR., THE COMMANDING GENERAL OF THE ARMORED COMMAND SAID, "THE STOUTEST ARMOR IS NO PROTECTION AGAINST NEGLECT. PREVENTIVE MAINTENANCE MUST BE AS RELENTLESS AS OUR TANKS IN COMBAT...." THAT'S WHAT THE WINTER DEMANDS—RELENTLESS PM."

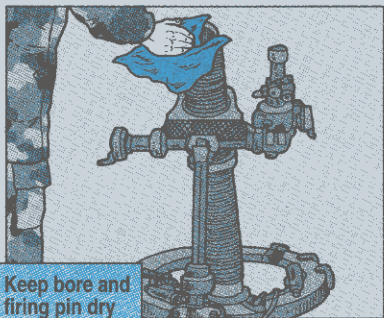


Defrost Cold Problems with PM

Cold can KO your mortar when it comes to firing—unless you counterpunch with this PM:

⇒ Lube with LAW instead of GPL when the temperature drops below 10°F. LAW does not get as stiff as GPL in cold weather.

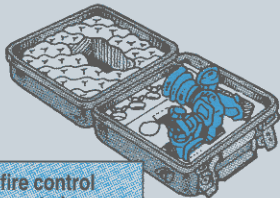
⇒ Wipe the inside of the bore dry before you go into the cold. That helps prevent ice from forming.



Keep bore and firing pin dry

⇒ Cover cartridges until they're ready to be fired. That stops ice from coating them.

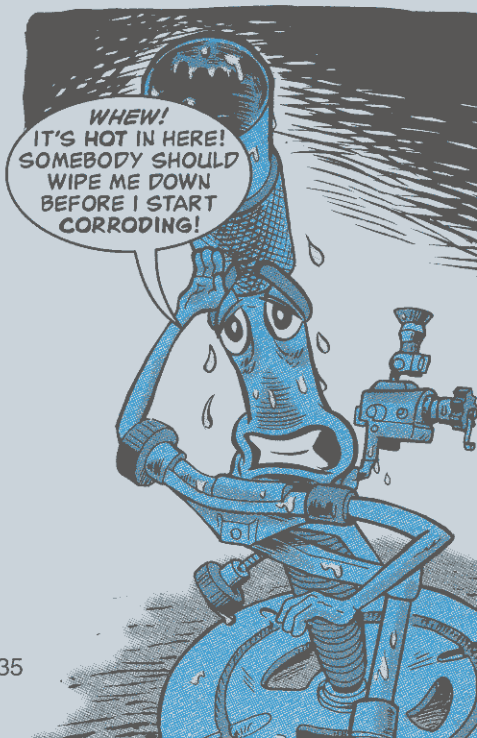
⇒ Keep fire control instruments in their cases. The cases cushion the instruments' delicate optics against the shock of the cold.



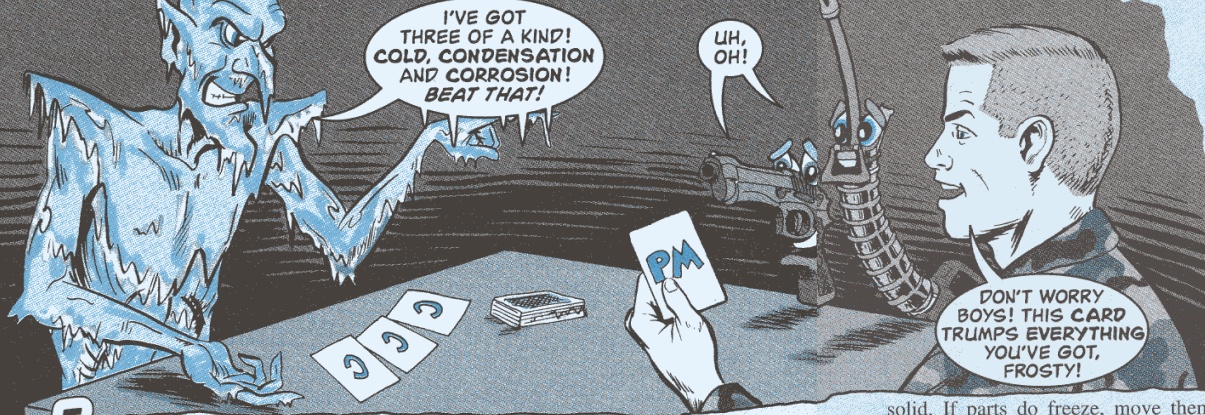
Keep fire control instruments in cases

⇒ Never bring fire control instruments directly from the cold into a warm place. The sudden change in temperature cracks optics and lets condensation form inside the instruments. Leave the instruments in a sheltered—but unheated—place where they can gradually warm before you bring them inside.

⇒ When you bring your mortar inside, wait at least an hour before cleaning and lubing it. That lets the mortar stop sweating from condensation and you can wipe out all moisture.



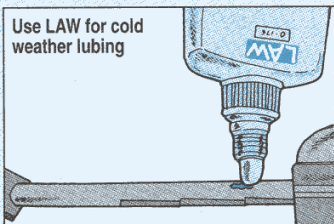
A Good Deal in Cold Weather



The cold will give your rifle or machine gun a raw deal if you ignore cold weather PM. Here's how to deal your weapon a winning hand:

- * Use rifle bore cleaner, NSN 6850-00-224-6663, to remove carbon, and use LAW, NSN 9150-00-292-9689, to lube your weapons when temperatures drop below 10°F. LAW helps moving parts on most weapons slide better in cold than CLP or LSA. The exception

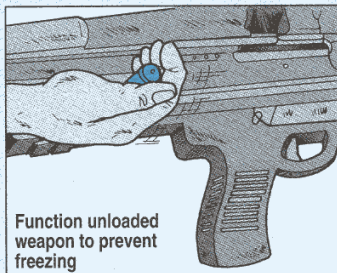
Use LAW for cold weather lubing



is the M249 machine gun. It needs CLP in all weather.

- * Prevent condensation from forming inside weapons by keeping them covered when you move from cold to warmth. That lets the weapon warm gradually.

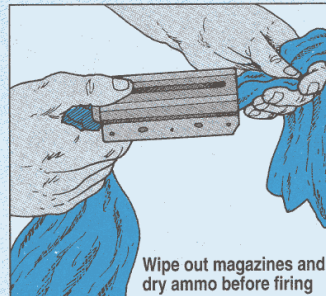
- * Hand function the weapon every 30 minutes to keep parts from freezing



Function unloaded weapon to prevent freezing

solid. If parts do freeze, move them slowly and easily until they move smoothly again. Forcing things breaks parts.

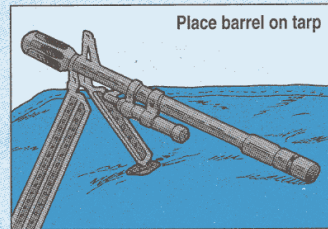
- * Keep ammo dry. If necessary, wipe ammo and the insides of magazines dry before firing. That wipes out moisture that will freeze and jam your weapon.



Wipe out magazines and dry ammo before firing

- * Never lay a hot weapon or barrel on the snow. Use a tarp or poncho to set it on.

Place barrel on tarp



- * Store weapons in a covered, wind-protected area when you're not using them. If that's not possible, cover them with a blanket or poncho. That at least shuts out ice and snow from the barrel, sights, and working parts.

- * Wait until a weapon warms to room temperature before cleaning it. A cold weapon will sweat with condensation. If you clean and lube the weapon before it quits sweating, the sweat freezes when you take it back outside.

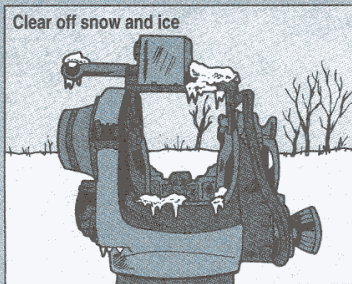


TOW WARMERS

Cold weather can bring your TOW low if you don't warm up to PM. Include these TOW warmers in your PMCS:

Keep ice and snow off clamping surfaces on the traversing unit, sights, and the missile. They prevent a good electrical connection. Usually, you can clear the surfaces with your hands.

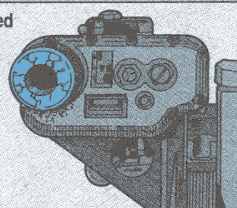
Clear off snow and ice



Rubber eyeshields on the optical and night sights freeze, collect ice and eventually crack. That leaves the delicate optics vulnerable to ice and snow. Report a cracked night sight, NSN 5855-01-070-4072 or op sight eyeshield, NSN 1440-01-050-4911.

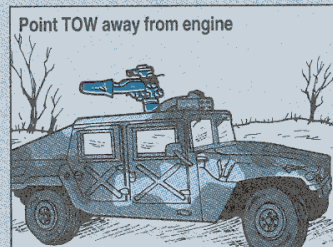
Do not breathe on optics in cold weather, either. That will fog and ice them.

Report cracked eyeshields. Don't breathe on optics



When extremely cold air hits the heat rising from the vehicle engine on mounted TOWs, the night sight's vision is distorted. Beat that distortion by parking your vehicle so the engine is away from the target.

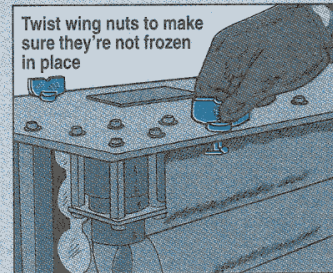
Point TOW away from engine



The wing nuts on the battery of the missile guidance set (MGS) freeze solid and then pop off when the battery's loaded. If there are fewer than four wing nuts, your MGS is NMC. Prevent seized nuts by twisting each one before you load the battery.

Your repairman can order extra wing nuts, NSN 5325-01-148-8601, and retainer rings, NSN 5325-00-298-6564.

Twist wing nuts to make sure they're not frozen in place



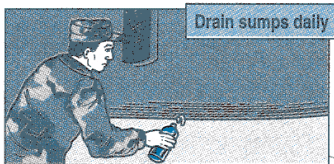
PM IN THE COLD

It's a time-consuming, patience-tasking job to keep 'em flying when the temperatures plummet and snow, wind and ice attack. But top-notch preventive maintenance on your aircraft is critical in cold weather.

Start your maintenance procedures by moving aircraft inside. If you can't, and you're faced with some extended maintenance, use a maintenance shelter or rig a temporary shelter out of tentage, other canvas, or a salvaged cargo parachute canopy. Warm your shelter with a ground heater. A warm, ventilated area will let you work without bulky clothing and heavy gloves.

Here are some of the areas you should concentrate on:

FUEL—Water in fuel can turn to ice that will block fuel lines. Keep fuel tanks topped off. The gap between the top of the tank and the fuel is full of cold moist air. That air causes condensation. That condensation drips into your fuel. When you take fuel samples, drain enough fuel to get rid of all the water. Drain the sumps daily.

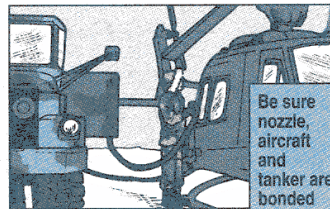


When you refuel a bird outside in sub-zero temperatures, always check the fuel level. When a full aircraft is moved into the hangar, the fuel level will rise with the higher temperature. Opening the filler cap will give you a fuel spill to clean up.

Static electricity can warm your winter real fast, but you won't be around to enjoy the warmth, so be extra careful during refueling. The colder it is, the drier the air is; the drier the air is, the more static electricity becomes a hazard.

Static can result from the aircraft moving through the air, or by brushing frost or snow off the aircraft. Fuel flowing through the filler neck can also generate a spark that ignites fuel.

Good grounds are hard to find, but the aircraft must be grounded. Make sure the aircraft and tanker are bonded together, and the nozzle is bonded to the bird before you remove the cap. When you're freezing while refueling you might be tempted to neglect a ground, but don't! Follow all your grounding procedures and take no shortcuts.

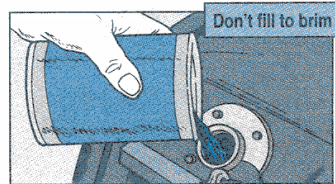


If you're not using a closed circuit fueling nozzle, put the regular nozzle in all the way. That'll keep static down and lessen the chance for a fuel spill.

Use extra care if you have to take fuel out of an aircraft. Spilled fuel can cause frostbite.

OIL AND GREASE—Fuel is not the only fluid affected by the cold. Most fluids get stiffer as temperatures fall; oil thickens, fuel's harder to ignite, and grease gels. You must use the right fuel and lube for cold weather. The lube chart in your TM lists the fuel, oil and grease to use.

When you service an oil tank on a cold-soaked aircraft, never fill it to the brim. Otherwise, when the oil heats up, the tank will overflow.



Oil leaks are a chronic problem in cold weather. Check connections, joints and seals regularly.

SEALS—Cold weather is hard on gaskets and seals. They contract and that leads to leaks. Moisture can seep in around seals and freeze and form ice that will cut seals. Make a list of your aircraft's seal and gasket potential trouble spots. Post that list next to these tips on your bulletin board.

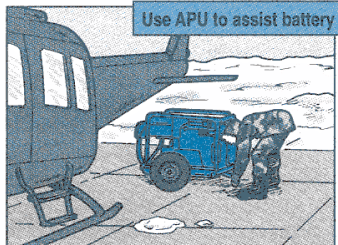


BATTERIES—Unless you're in the deep freeze for a long string of days, your nickel-cadmium batteries will do their job well in cold weather without too much extra effort on your part. However, every cold start shortens their life. So, if possible, bring your batteries indoors when the weatherman predicts several days of sub-freezing tem-



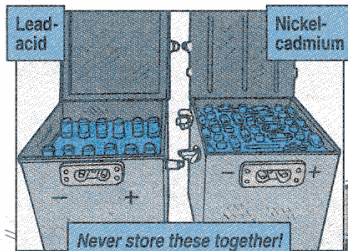
Remove batteries and store in warm place

peratures. If it's not possible, turn on the landing lights, searchlight or other equipment for 30 seconds before an engine start. That "load" will warm up the battery a bit. Always use an auxiliary power unit APU on the first start of the day. It saves a lot of drain on cold batteries.



Use APU to assist battery

Lead-acid batteries should also be kept warm. Cold weather saps their charge much faster than it does a nickel-cadmium battery. If you bring your batteries in, never store nickel-cadmium and lead-acid in the same area. Fumes from a lead-acid battery can cause a discharge of a nickel-cadmium battery.



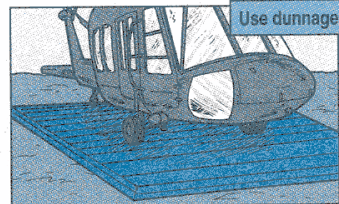
Never store these together!

Place the batteries on a shelf or on dunnage, not on a bare floor.

TIRES—Air pressure drops with the temperature, so check your bird's tire pressure often.

Tires frozen to the ground can be freed with liquid deicer. Move the aircraft immediately to keep it from freezing down again as the slush formed by the deicer refreezes.

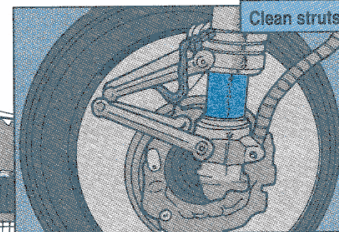
Use boards, dunnage or something similar under tires to keep them off snow or ice.



Use dunnage

OTHER AREAS—The tension of steel decreases due to the higher contraction of the aluminum airframe. A bolt that is overtightened on a warm day could shear off as the bolt shank contracts.

Check your landing gear often. Use a clean rag dampened with hydraulic



Clean struts

fluid to remove ice, dirt and grit from struts and pistons.

Service pressurized systems according to the instructions in each aircraft maintenance manual. Remember that any moisture present will freeze into ice crystals and damage seals.

Avoid bending rubber hoses or rubber-covered wires while they're cold soaked. Rubber gets brittle and stiff and could crack.

COLD WEATHER GUIDES—For more information on winter maintenance operations, check out FM 31-70 and FM 31-71.

YOU CAN'T CHANGE THE WEATHER... BUT YOU CAN PREPARE FOR IT.

GOOD PM KO'S COLD EVERY TIME!

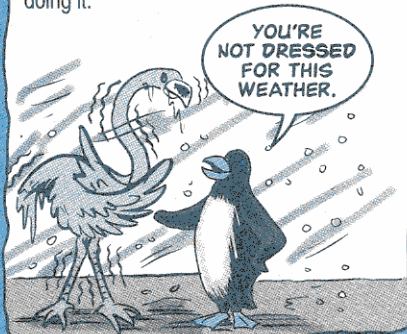
The Four Colden Rules



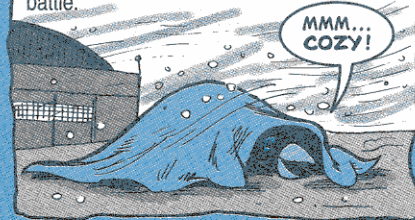
IF YOUR TOASTY TOOTSIES ARE PROPPED ON YOUR DESK AND ALL YOUR BIRDS ARE ROOSTING IN HANGARS, DROP THIS MAG AND GRAB SPORTS ILLUSTRATED!

BUT... IF YOUR FEET ARE FREEZING AT THE VERY THOUGHT OF DOING MAINTENANCE ON FROZEN FLIGHT-LINE BIRDS, READ ON.

Rule One: Dress like a 5-minute maintenance job is going to take an hour. Bundle up and wear gloves. If you don't...if you dress like you're going to your porch to get the newspaper...you'll rush the job, pull poor PM and risk exposure illnesses. Sure, winter clothing is bulky. Just allow more time to do the job and take your time while doing it.



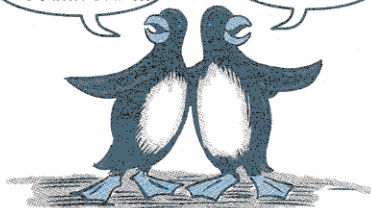
Rule Two: Cover your bird. If your bird is covered, you've won half the cold weather battle.



Rule Three: Resist the urge to use shortcuts. If the cold is too intense, break your maintenance task into small chunks or use the buddy system; one mechanic warms while the other works.

IT TAKES TEAMWORK...

...TO BEAT THE COLD!



Rule Four: Grounding your bird is critical. The colder the weather, the drier the air; the drier the air, the more static electricity generated.

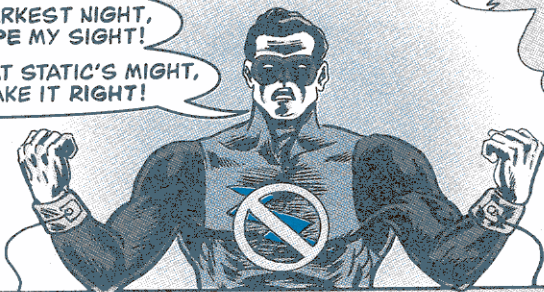
BUT I'M ALREADY PERMANENTLY GROUNDED!



Too Much Static

IN BRIGHTEST DAY, IN DARKEST NIGHT,
NO STATIC WILL ESCAPE MY SIGHT!

FOR THOSE WHO TREMBLE AT STATIC'S MIGHT,
FEAR NO MORE, I'LL MAKE IT RIGHT!



Static electricity does more than just make your socks cling to your pants in the dryer. An unexpected static discharge during ammunition handling or aircraft fueling could fry you and your equipment.

Winter adds two factors that increase the static discharge risk—cold, dry air and synthetic cold-weather clothing.

Synthetic fabrics develop greater static charges and hold those charges longer than natural fabrics. Parka, NSN 8415-01-228-1306, and pants, NSN 8415-01-228-1336, of the extended cold-weather clothing system (ECWCS) contain synthetics.

The keys to reducing wintertime static discharge risk are:

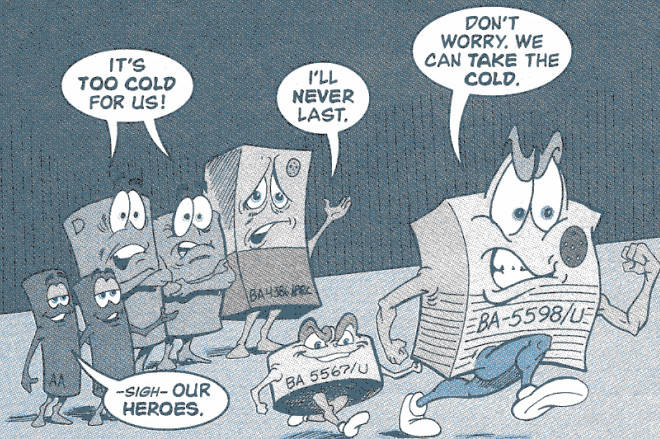
- Identify hazards. Hazards are electrically charged objects in your work area like rugs, chairs, paper, and packaging materials. But the prime source of static is you. You build up volts of static electricity by doing everyday things like walking across the floor or combing your hair.
- Eliminate the static buildup on your clothes. The only way to eliminate static buildup is a good ground. That means using grounded floor mats and wrist straps. The ESD field service kit, NSN 4940-01-253-5368, includes a mat, antistatic pouches, wrist straps, grounding cords and barrier bags.
- Read the TMs and FMs that cover aircraft fueling, ammunition handling and electronic maintenance. Get a copy of MIL-HDBK-263, Electrostatic Discharge Control Handbook and MIL-STD-1686, Electrostatic Discharge Control Program.

Order these publications from the Department of Defense Single Stock Point at:

DODSSP
Bldg 4, Section D
700 Robbins Avenue
Philadelphia, PA 19111-5098

Get the order form on their web site at:
<http://www.dodssp.daps.mil/1425a.pdf>

Assault on



Winter weather turns dry-cell batteries (carbon, zinc, alkaline) cold. And cold batteries may not deliver the power your commo gear needs.

That's why you should know about cold-resistant batteries and cold weather battery care.

Cold-Resistant Batteries

Look at your equipment's TM and SB 11-6 for specific information on batteries for cold-weather operation.

Both list primary battery-using equipment, battery type numbers, descriptions, storage temperatures and NSNs.

You can find the latest info on CECOM batteries at:

www.monmouth.army.mil/cecom/lrc/lrhcq/power.html

This web site also contains the latest on CECOM batteries and a link to battery safety messages.

Here are two batteries especially made for cold weather:

The BA-5598/U lithium battery, NSN 6135-01-034-2239, will outlast the magnesium, BA-4386/PRC-25, NSN 6135-00-926-8322, in cold weather.

The BA-5567/U lithium battery, NSN 6135-01-090-5365, used in night vision devices, lasts longer than AA alkaline batteries in the cold. Get a package of 12 with NSN 6135-01-447-5082.

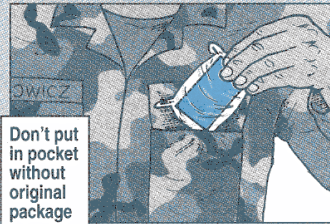
Batteries

Battery Care

When temperatures plunge, batteries need extra care.

Keep them stored until you're ready to move out. Then warm up only as many spares as you'll need. Lithium batteries won't need warming up unless they've been in temperatures below -20°F.

Protect dry cells by keeping them out of the cold and wind. Cover them with your clothing. Put them in a vehicle or commo shelter when possible. Sheltering batteries behind a wind break is better than leaving them out in the open. Putting them next to your body is best of all, but only if they are still in the original package. Otherwise, metal objects in your pockets could create short circuits.



Never stow batteries next to a heater or stove. That's too much warmth for most batteries and they could vent or rupture.

Keep spare batteries handy so you can make a switch when the ones in your gear start to fade. When you remove batteries from your gear, put

them in an inside, empty shirt pocket to warm up. After a while, they'll regain their punch.

Never store a lithium battery in your clothing after the Complete Discharge Device (CDD) has been activated. The battery could vent harmful gas. In fact, don't push the CDD while you're on an exercise. Return it to the installation for handling and disposal.

If you won't be using your gear right away, don't install the batteries. Keep them warm as long as you can.

If you warm batteries in a heated place, watch for sweating. Wipe off any moisture or it'll freeze.

Finally, if your gear has plastic pins in the battery compartment, take care when installing the battery. Cold pins become brittle. They'll break if they're handled too roughly.

Cold pins can break when mated



THE RIGHT BATTERIES AND GOOD PM WILL TAKE THE CHILL OUT OF WINTER.

Cables in the Cold

HEY!
EASY WITH
THE ROUGH STUFF
OR I'LL...

...TOO
LATE! SEE WHAT
I MEAN?

CRACK

Extrême cold is brutal on field and telephone cable. Insulation turns stiff and brittle. It cracks and breaks open if cable's handled too roughly. Once that happens, moisture seeps into the wire conductors and causes a short.

Field ties and splices, and kinks and crimps in the line are especially vulnerable to cracking.

Cold also shrinks and stiffens wire conductors, making them more liable to break.

Not only is cold cable more likely to crack, it's also stiff and harder to handle. A reel of cable may even freeze into its coiled shape.

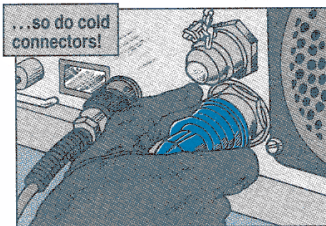
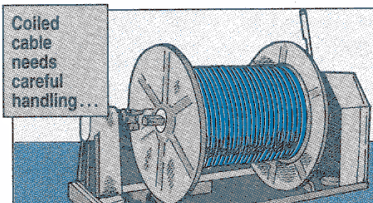
The remedy for cold cable is a warm shelter and careful handling.

Take tightly coiled cable, unwind it into bigger coils, and store it where it's warm before taking it out in the cold. That'll reduce the risk of a pinch or break.

The same principle goes for recovering cold, stiff cable, too. Before coiling it, warm it up, if possible.

And don't forget to handle cold cable carefully. Slow and easy is the way when you pay out, reel in or flex cable.

If you have to splice or repair cable, use TL-600 cold weather tape, NSN 5970-00-240-0620, which comes in a 30-ft roll. This tape holds fast in cold



weather and can be used without being warmed up. Most other friction and rubber tapes don't hold as well in extreme cold.

One more reminder: Metal connectors and receptacles shrink in the cold, making cable connections stubborn. Here again, take care when you hook up or unhook cables. Rough stuff just invites damage.

Night Vision Goggles ...

Bad Breath

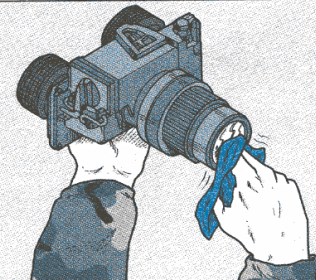
Tempted to wipe off the night vision goggles' optical lens with just any old cloth? Resist that temptation. That's a sure way to scratch the lens, especially in cold weather.

Always use cleaning tissue, NSN 6640-00-240-5851, to wipe the lens.

Also, in cold weather, resist the temptation to breathe on the optical lens, and wipe off the moisture with a cloth. If it's below freezing, your breath will frost the lens. When you wipe away the frost, you're bound to leave behind nasty scratches.

Instead, follow this cold-weather cleaning tip: Wipe dirt and smudges off with only lens cleaning tissue. Save your breath for warmer weather.

Always clean lens with cleaning tissue



MORE BAD BREATH



In wintertime, your breath can be hazardous to your TA-312 telephone.

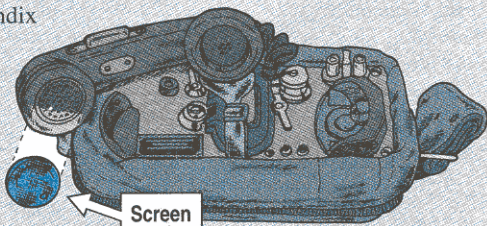
No, not bad breath, but warm breath that condenses and forms moisture when you speak into the cold telephone mouthpiece.

The moisture gets inside the mouthpiece, freezes on the transmitter and stops your call from going out.

Protect your phone when temperatures dip below freezing. Snap the deicing screen on the outside of the TA-312's mouthpiece. The screen keeps out moisture.

You'll find the screen in Appendix D of TM 11-5805-201-12. Note that the NSN is wrong, though. Use NSN 4130-00-392-7628.

Some people think they'll lose the screen if they put it on the outside, so they unscrew the mouthpiece cap and put the screen inside. It can't keep out moisture in there.



If you install the deicing screen the right way, it'll stay on the mouthpiece. Here's how:

- Lay the screen on the face of the mouthpiece.
- Press the screen evenly around the rim with your thumb or finger. That'll seat it firmly in the slot on the mouthpiece.
- If you use a screwdriver or knife to remove the screen, be careful not to cut or damage it. You'll lose the protective seal.

When you're not using the screen, tape it to the side of the TA-312, between the phone and the carrying case. That way it won't get lost.

Tents and Cold Weather

your tent may be all the protection you get from frigid winter winds. Treat it right to make sure it treats you right.

Substitute 12-in steel pins, NSN 8340-00-823-7451, for the usual aluminum pins. If the ground's frozen too hard to even get the steel pins in, chop small holes in the ground for them. Then, fill the holes with slush or water. It'll freeze and anchor the pins.

Remove tent pins from frozen ground by chopping the ground around them until they loosen up. Never pound them sideways with a hammer to break them loose. You'll just bend them and make them harder to use next time.

Tent ropes must be tight to stand up to high winds. When the weather's wet, though, they need some slack to allow for shrinkage.

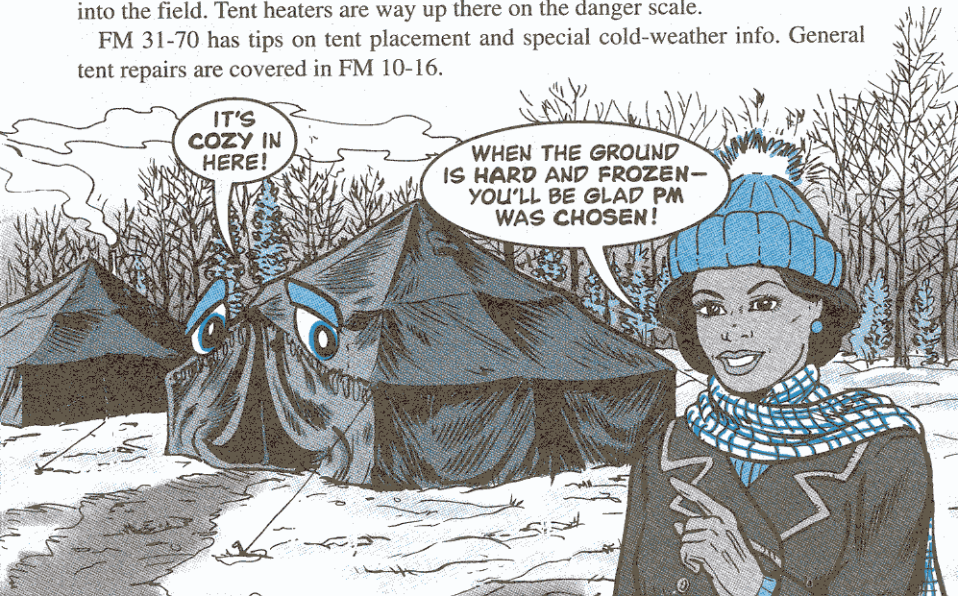
Slide fasteners that won't slide are a nuisance. Slide fastener lubricant, NSN 9150-00-999-7548, unsticks 'em.

On frame-type tents, cold canvas won't always completely cover the frame like it should. Never force it. Lay it over the frame and secure it. When heat from inside the tent warms the canvas, finish tying it down.

Step carefully when you go in or out of the tent wearing extreme cold-weather clothing and boots. The bulky winter gear catches on the door and zipper and can tear the canvas.

Finally, make sure you're up to speed on tent heater operations before you go into the field. Tent heaters are way up there on the danger scale.

FM 31-70 has tips on tent placement and special cold-weather info. General tent repairs are covered in FM 10-16.



Be Toasty, Not Toast

IT REALLY BURNS ME UP WHEN YOU DON'T PULL PM ON ME!

FIRE!
GET OUT!

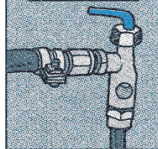
You count on the M1950 Yukon heater to keep you toasty in cold weather—and it will. But if you forget PM or safety, it will just leave you toast.

Flames can shoot through a tent in less than 10 seconds, so follow the procedures in your operator's manual, and use these tips for safe heater operation:

Do It Right

- Always clean and inspect the heater before operation or storage. Clean the heater by the book—TM 10-4500-200-13.
- Never refuel a heater that is in operation or is still hot. It's too easy to ignite fuel.
- When refueling always make sure the drip valve is fully closed before you set up the new fuel can. If you don't, fuel will pour directly onto the hot burner when the new can is set up. You could have a fire or explosion.
- Always post a fire guard at night.
- Make sure there's enough ventilation.
- Never operate the heater at full capacity. An overheated stove can warp its grate or cause a fire.
- Have fire extinguishers available in every tent that has a stove or heater.
- Keep flammable material, such as pine needles or tree boughs, away from the heater.
- Always use drip pans. Without them, fuel from leaks drips directly onto the ground. If fuel comes in contact with coals or flame, you've got a problem.
- Never block exits with MREs, water cans, or by rolling the snow flaps inside and holding them down with personal gear. In case of a fire, seconds count.

Make sure drip valve is fully closed clockwise



Fuel for Thought

Fuel hoses start to leak or break when the temp falls below -20°F . Warm the hoses before uncoiling them, and try to make all connections in a warm area. Make arctic hoses that are good to -65°F by using hose, NSN 4720-00-542-3304.

Use a can cradle, NSN 7240-01-318-5222, to hold the heater's 5-gal fuel can. It's sturdy, lightweight, field-repairable and can be folded for easy storage.

NSN 7240-01-318-8636 brings replacement straps for the cradle.



Stack Facts

The tapered stack of the M1950 was not made to be extended beyond its normal length. Extensions can:

- leak carbon monoxide
- fall and set fire to your tent
- prevent the use of the draft diverter. This causes sparks to fly and your tent could catch fire.

Use the M1950 only in tents that need a stovepipe no higher than eight feet, such as the 5- and 10-man arctic tents.

If you need more stack, like for a GP tent, use the H-45 heater, NSN 4520-01-329-3451.

Fix it Fast

You can get a burner repair kit for a Yukon's oil burner with NSN 4520-01-202-4520. The kit contains a loop and two retainers, cotter pins and screws.

HOT Not So Hot



IF YOU DON'T WANT TO BE LEFT OUT IN THE COLD BY YOUR EXTENDED COLD WEATHER CLOTHING, HERE ARE A FEW THINGS YOU NEED TO HANG IN YOUR PM CLOSET.

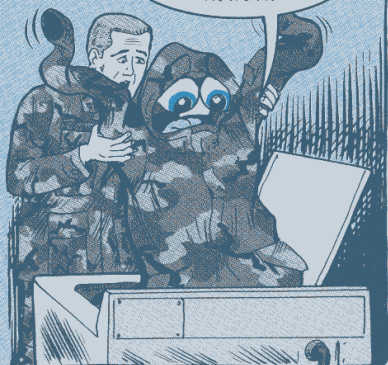
SHEESH!
I'M SOAKED! THIS PARKA IS RIPPED!



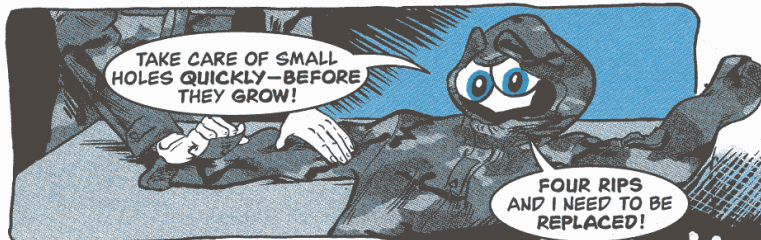
Wash ECWCS only in warm water. Washing in hot water hurts the fabric's water repellency and fades its color. Wash ECWCS in warm water on PERMANENT PRESS or NORMAL COTTON STURDY cycles. Use any standard liquid or powdered detergent, but no bleach. Rinse **thoroughly** in warm water. Any detergent left on the fabric hurts water repellency.

Tumble dry on PERMANENT PRESS, high setting. Do not overdry. Tumble drying ECWCS restores water repellency.

I'LL COME CLEAN! JUST DON'T PUT ME IN HOT WATER!



Patch small holes before they become big holes. Take a patch kit to the field and repair holes or rips as soon as possible. Follow the instructions on the kit. If you leave a hole unrepaired for long, it can get too big to repair and the clothing must be tossed. The patch kits are available at military clothing sales stores.



TAKE CARE OF SMALL HOLES QUICKLY—BEFORE THEY GROW!

FOUR RIPS AND I NEED TO BE REPLACED!

You can't patch ECWCS more than three times or patch more than a total of 15 inches in length. After that, it must be turned in.

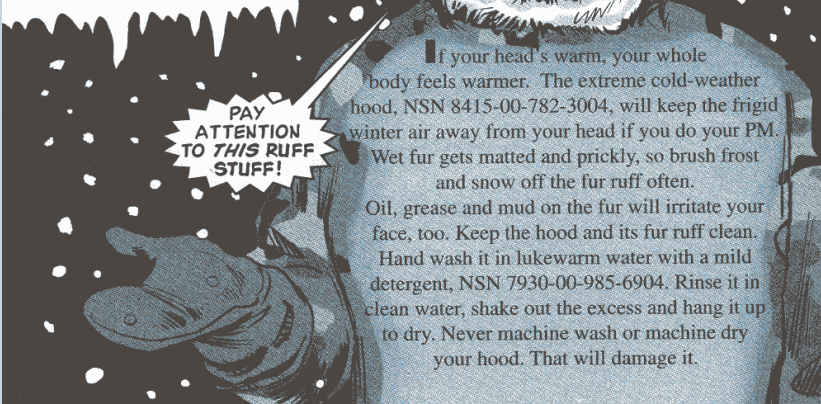
If you notice that moisture no longer beads up on the clothing's outside, use a water-repellent laundry additive, NSN 8030-01-408-9446. Follow the instructions on the label.

Extreme Cold Weather Hood ...

RUFF TREATMENT

If your head's warm, your whole body feels warmer. The extreme cold-weather hood, NSN 8415-00-782-3004, will keep the frigid winter air away from your head if you do your PM. Wet fur gets matted and prickly, so brush frost and snow off the fur ruff often. Oil, grease and mud on the fur will irritate your face, too. Keep the hood and its fur ruff clean. Hand wash it in lukewarm water with a mild detergent, NSN 7930-00-985-6904. Rinse it in clean water, shake out the excess and hang it up to dry. Never machine wash or machine dry your hood. That will damage it.

PAY ATTENTION TO THIS RUFF STUFF!



PM STOMPS BOOT PROBLEMS

Anyone can get cold feet—on the range, in the motor pool, anywhere—when temperatures hit single digits or colder.

So follow these PM tips in caring for your cold-weather or extreme cold-weather boots:

Watch Your Step

Puncturing a boot can put it out of action for good. That lets water get in the layer of insulation that's sealed inside. Wet insulation lets the cold through, and your feet get frostbitten.

Patch holes as soon as you find them using the cold-weather boot maintenance kit, NSN 8465-00-753-6335. Put the adhesive on both the boot and the patch.

Never expect the patches to hold up long in the field, though. They're only good for emergencies. When you come back in from the field, turn the boots in for testing.

Keep the air pressure relief valve closed unless you're flying in an aircraft. If it's open, it lets in almost as much moisture as a puncture. Make sure to close it once you land.

Squeaky Clean

Clean your boots by washing them with a mild detergent and water. Wash the insides at least once a month. Take the laces out and clean between the tongue and the eyelets. Dirt or grit there can wear a hole in the boots.

For stubborn stains, use a spray-on general purpose detergent, NSN 7930-00-357-7386.

Never use paint or shoe polish to cover scratches or scuffs on your boots. They break down the rubber coating. Soon you'll have to get a new pair.

Put a Sock in It

Putting on damp socks is not much different than going barefoot. Either way, your feet will be very, very cold.

When you're in the field, carry extra dry socks and change them often.

Never place your boots next to a heat source—like a Yukon stove—at the end of the day. Your boots will be nice and dry the next morning, but they may be sticking to the floor.

When you're in the field, try hanging your boots up high from the center of the tent. The heat from the space heater rises and dries your boots without melting them.

Lace 'em Up

Get replacement white laces for your extreme cold-weather boots with NSN 8335-00-131-6538. Use NSN 8335-00-945-3969 to get black laces for your cold-weather boots.



Water Cans...

Keep 'em from the Cold

Here are a few hot ideas to protect water cans during cold temperatures.

Leave room for expansion. Water and other liquids in cans will freeze. To prevent damage, fill cans to within three inches of top.

Get insulating case, NSN 7240-00-125-9061, for cans.

Keep cans inside tent or vehicle and off ground.

Never apply heat to frozen can or plastic will melt.



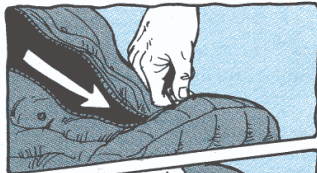
KEEP IT ZIPPED KEEP IT ZIPPED

A zipper that comes unzipped on your extreme cold-weather sleeping bag lets in a draft that'll freeze your bones.

BRR- WHAT HAPPENED TO THE ZIPPER?!

To keep the cold air out and your bones nice and warm, take a shot at fixing the zipper yourself.

Pull the zipper all the way down to the bottom of the bag. Then, slowly and carefully, pull it back up. Nine times out of ten, the zipper will reattach itself and the teeth will mesh.

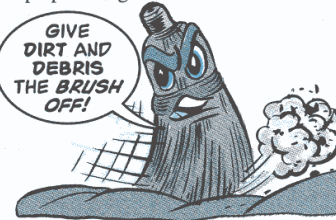


If the zipper teeth won't hold the first time, try zipping and unzipping a couple more times.

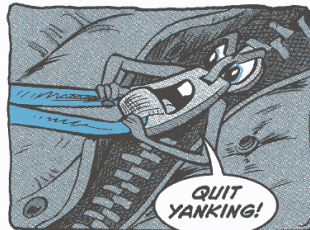
No luck? Turn in the bag.

Of course, the best thing you can do is prevent the zipper from breaking in the first place. Follow these PM tips and you'll always have a sleeping bag you can count on:

◆ Brush off any dirt or debris that's on the sleeping bag. That keeps grit from getting caught in the teeth when you zip up the bag.



◆ Pull slowly and evenly when zipping up the sleeping bag. Hold onto the zipper lever itself rather than the attached thong. That'll save wear and tear on the zipper.

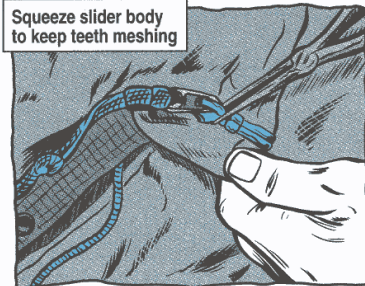


◆ Use zipper lube, NSN 9150-00-999-7548, on new zippers and whenever the zipper starts sticking or gets hard to pull. With the zipper closed, rub a little lube over the zipper teeth. Then work the zipper up and down a few times until it moves easily. A bar of soap or a candle works well in a pinch. Just run either one up and down the teeth. Then open and close the zipper several times to spread the soap or wax.



◆ Never run your sleeping bag through the pressure wringer of a wringer-type washing machine to squeeze out excess water. Your bag will be drier, but you'll have to replace the flattened zipper.

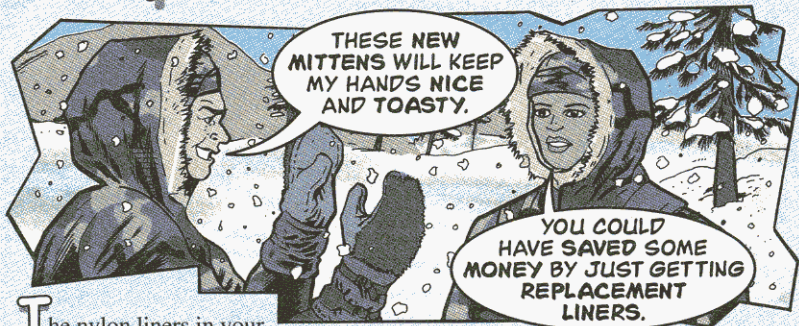
Squeeze slider body to keep teeth meshing



◆ If the teeth continue to separate, use a pair of needlenose pliers to gently squeeze down the flat portion of the slider body. Hard pulls and continued use cause the slider body to open just a bit. Then the teeth don't mesh properly and come apart.

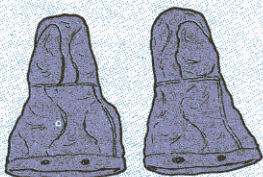


Replacement Liners



The nylon liners in your arctic mitten set, NSN 8415-00-782-6715 through -6717, can wear out faster than the mittens themselves.

Don't waste money buying new mittens. Get new liners instead with these NSNs:



NSN 8415-01-323-	Size
2174	Small
2175	Medium
2176	Large

Get a new drawstring harness with NSN 8415-01-323-2177.

Gloves You Can Work With

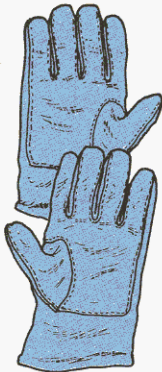
Cold metal can freeze to your skin the instant you touch it. But cold-weather mittens are too bulky to do much more than hold and fire a rifle. So what's a soldier to do?

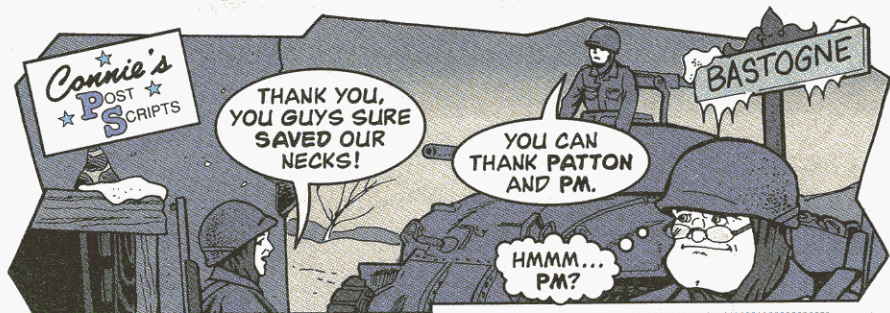
Thin, anti-contact gloves are the answer for short-term use. These cotton gloves are lined with deerskin palms. They keep your hands from sticking to metal in below-zero temperatures when you need quick contact protection.

Here's what's available:

NSN 8415-00-227-	Size
1220	Small
1221	Medium
1222	Large

Never wear the gloves longer than you have to. They're meant for quick contact protection. They won't protect your hands for very long. Replace 'em when they get frayed, worn or torn.





RS-28 Vibratory Roller Cables

If you need only the engine throttle cable shown as Item 1 in Fig 39 of TM 5-3895-346-24P, ask for NSN 2590-01-164-7933. Likewise, use NSN 3040-01-227-7370 to get the forward/reverse cable shown as Item 1 in Fig 58. The cables are not listed separately in the TM.

XL PASGT Helmet

Use NSN 8470-01-300-3819 to get an extra-large Protective Armor Systems, Ground Troops (PASGT) helmet. TM 10-8400-203-23 doesn't list this NSN.

Windshield Scraper

Keep glass scraped free of ice with a windshield scraper, NSN 7920-00-045-2556. Use Appendix A of CTA 50-970 as your authority.

ETM Updates

To get updates to any electronic technical manual (ETM) you receive on compact disc (CD), you must submit a subscription change requirement. Updated CDs will *not* be sent automatically. To order, use the initial distribution number (IDN) that's printed on the cardboard mailer and on the CD.

Don't Overheat ECWCS

If you've noticed the coating on your extreme cold weather clothing system (ECWCS) bubbling up, the culprit is most likely a hot dryer. High heat is a killer for this clothing. Check the labels. Keep dryers set on medium or low heat.

M939-, A1-Series Starter

To get the starter for M939-series and M939A1-series trucks, use either NSN 2920-01-075-2813 or NSN 2920-01-069-6997. The starter shown as item 2 of Fig 44 in TM 9-2320-279-20P is no longer available.

PS Prices Up

The yearly subscription price for PS has gone up. Private citizens or business firms who want to subscribe to PS or renew a subscription will now have to pay \$22 in the US (including APO/FPO addresses). The foreign address price is now \$27.50 (US currency only). Send your request to:

Superintendent of Documents
PO Box 371954
Pittsburgh, PA 15250-7954

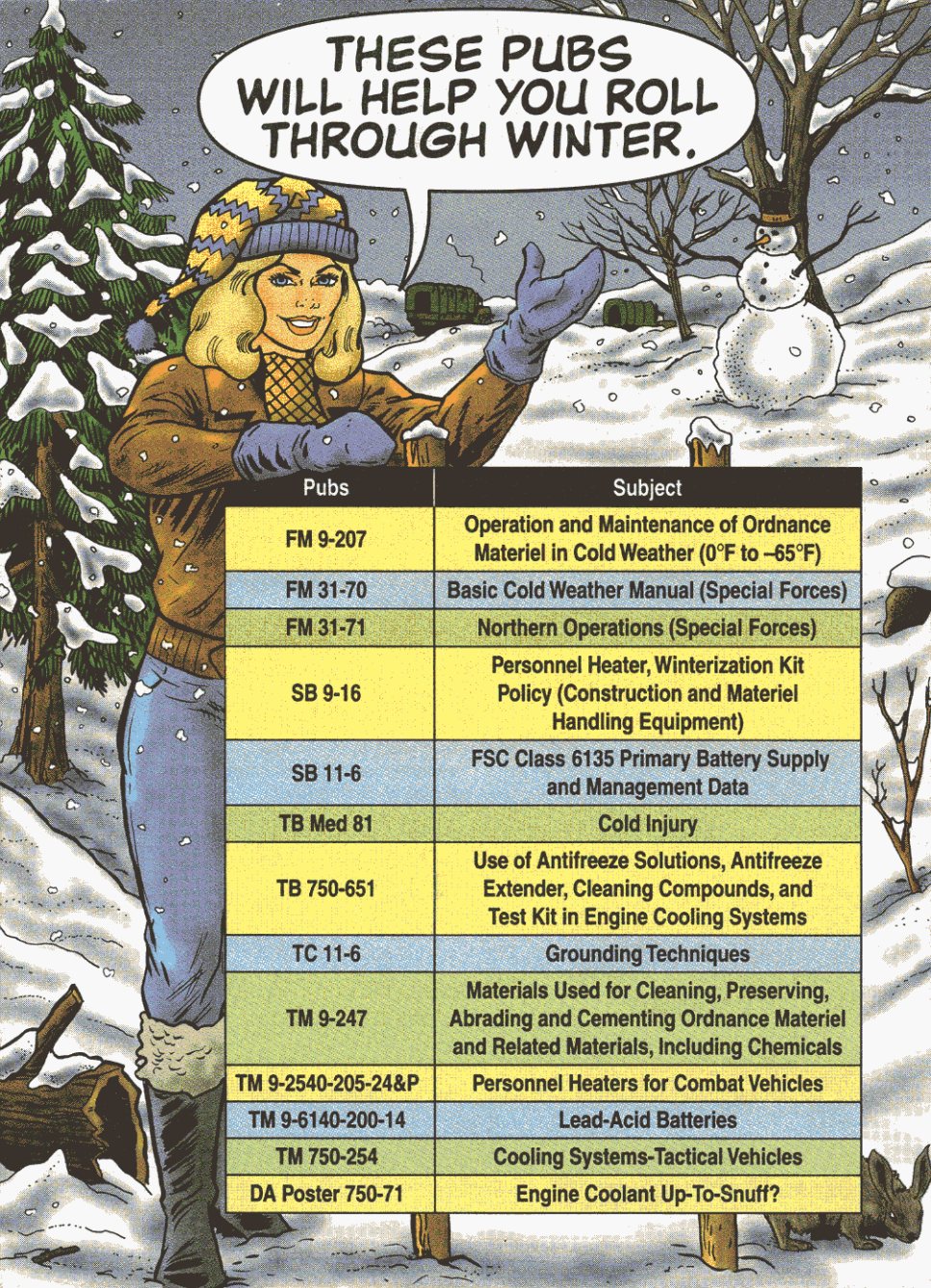
To order by credit card, (VISA, Mastercard, and Discover) call GPO at (202) 512-1800 or fax (202) 512-2250. Ask for PS, The Preventive Maintenance Monthly, stock number 708046000000-1.

DISTRIBUTION: To be distributed in accordance with the initial distribution number (IDN) 340312, requirements for TB 43-PS-Series.

Would You Stake Your Life *right now* on the Condition of Your Equipment?

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Pubs	Subject
FM 9-207	Operation and Maintenance of Ordnance Materiel in Cold Weather (0°F to -65°F)
FM 31-70	Basic Cold Weather Manual (Special Forces)
FM 31-71	Northern Operations (Special Forces)
SB 9-16	Personnel Heater, Winterization Kit Policy (Construction and Materiel Handling Equipment)
SB 11-6	FSC Class 6135 Primary Battery Supply and Management Data
TB Med 81	Cold Injury
TB 750-651	Use of Antifreeze Solutions, Antifreeze Extender, Cleaning Compounds, and Test Kit in Engine Cooling Systems
TC 11-6	Grounding Techniques
TM 9-247	Materials Used for Cleaning, Preserving, Abrading and Cementing Ordnance Materiel and Related Materials, Including Chemicals
TM 9-2540-205-24&P	Personnel Heaters for Combat Vehicles
TM 9-6140-200-14	Lead-Acid Batteries
TM 750-254	Cooling Systems-Tactical Vehicles
DA Poster 750-71	Engine Coolant Up-To-Snuff?