

Issue 491

TB 43-PS-491

PS

October  
1993

# THE PREVENTIVE MAINTENANCE MONTHLY

Read this copy  
and pass it on!



OLD MAN  
WINTER  
IS HERE—  
OOPS!

THAT REMINDS ME,  
WE'D BETTER NOT SLIP UP  
ON OUR WINTER PM!

Approved for Public Release;  
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# COPING WITH THE COLD

AS YOU MAY HAVE LEARNED THE HARD WAY LAST YEAR, TRYING TO GET THROUGH A COLD WINTER WITH ORDINARY MAINTENANCE JUST WON'T CUT IT.

I REMEMBER IT WELL...



Operating in the cold calls for something extra. And that something extra starts with good maintenance habits. This is simply orienting yourself for conditions that will actually exist — conditions that can frustrate the best mechanics and operators if they're not ready to meet the hazards head on.

In cold weather, there is hidden danger to equipment and soldiers.

- ❖ **LUBRICANTS** become stiff and hard to use.
- ❖ **PLASTIC AND HARD RUBBER PARTS** become brittle. A hard knock or a sharp bend may snap them.
- ❖ **GAUGES AND DIALS** stick and give wrong readings.
- ❖ **BRAKES** freeze to drums when wet.
- ❖ **FUEL TANKS, FILTERS AND LINES** freeze tight or ice up from condensation.
- ❖ **LINKAGES** get stiff, causing hard operation or delayed response.
- ❖ **PAINT** becomes brittle and cracks easily.
- ❖ **CRANKCASES** sludge up from condensation caused by short runs.
- ❖ **BATTERY** efficiency is cut. They freeze and crack when discharged.
- ❖ **ENGINES** are hard to start, with threat of hydrostatic lock.
- ❖ **MACHINED AND UNPAINTED SURFACES** rust and corrode quickly.
- ❖ **DRAIN COCKS AND PLUGS** freeze tight, discouraging daily or periodic draining.
- ❖ **POWER TRAIN BREATHERS AND VENTS** clog from slush and freeze closed.
- ❖ **WINDSHIELDS** crack easily when hit by a blast of cold air from the defroster.
- ❖ **PERSONNEL EFFICIENCY** drops.

And since the wind-chill factor can have you operating at  $-50^{\circ}\text{F}$  at times, make sure there are at least two people assigned to any outside task. Not only is the extra help needed, but each can watch the other for signs of frostbite, which can strike FAST!

## Winter PM Checklist

- ❖ Be acquainted with the cold weather operation portion of your operator's TM.
- ❖ Lubricate according to the temperature range on your gear's L.O.
- ❖ Keep your extreme cold-weather TMs, TBs, FMs and other cold-weather pubs within reach for quick reference. Look 'em over before the cold blast hits to offset any trouble due to lack of know-how.
- ❖ Try no short-cuts, alterations or repairs that are beyond your MOS.
- ❖ When in doubt whether winterization treatments apply, check with someone who knows.

You learn right off that just about any task may take twice as long to do. So make sure you allow enough time to get the job done right.



THE PREVENTIVE MAINTENANCE MONTHLY

TB 43-PS-491, 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.

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

MSG Half-Mass  
The Preventive Maintenance Monthly  
Bldg 4123  
Redstone Arsenal, AL 35898-7466

By Order of the Secretary of the Army:

**GORDON R. SULLIVAN**  
General, United States Army Chief of Staff

Official:

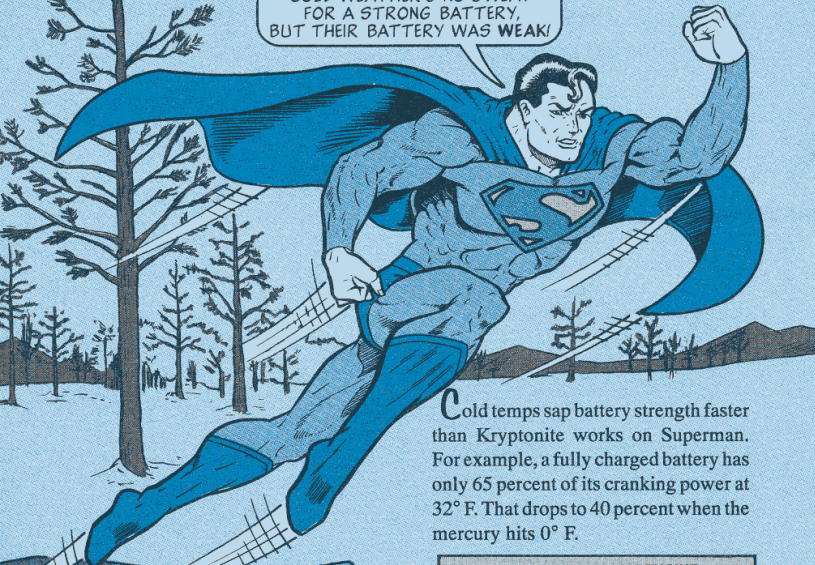
*Milton H. Hamilton*  
**MILTON H. HAMILTON**

Administrative Assistant to the Secretary of the Army  
05033

PS, The Preventive Maintenance Monthly (ISSN 0475-2953) is published monthly by the Department of the Army, Redstone Arsenal, AL 35898-7466. Second Class Postage is paid at the Huntsville, AL post office and at additional mailing offices. Postmaster: Send address changes to PS, The Preventive Maintenance Monthly, Redstone Arsenal, AL 35898-7466.

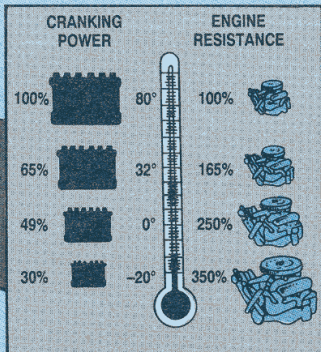
# Test Batteries Now for Sure Starts Later

COLD WEATHER'S NO SWEAT FOR A STRONG BATTERY, BUT THEIR BATTERY WAS WEAK!



Cold temps sap battery strength faster than Kryptonite works on Superman. For example, a fully charged battery has only 65 percent of its cranking power at 32° F. That drops to 40 percent when the mercury hits 0° F.

HE'S BETTER THAN SLAVE CABLES!



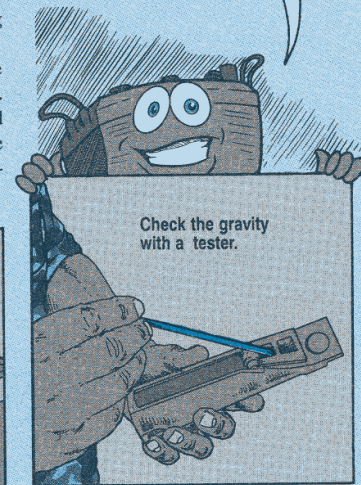
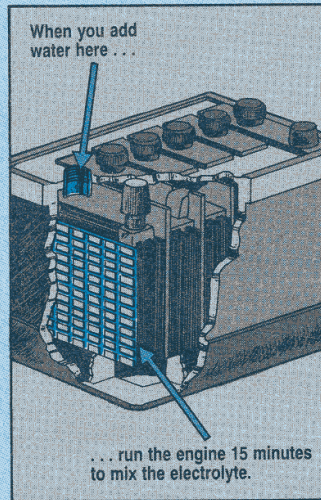
## Test Specific Gravity

BEFORE YOU PUT A DIFFERENT BATTERY ON THE JOB, MECHANICS, TEST ITS SPECIFIC GRAVITY. IT TELLS YOU THE BATTERY'S STATE OF CHARGE!

How you check 'em is important. You can't tell the true condition of a battery if you test only the water. That's just what you do if you add water and test. The water stays at the top of the cells.

If you add water, start the engine and let it run for at least 15 minutes. This gives the vehicle's charging system a chance to mix the water and electrolyte. This also keeps the water from freezing and cracking the battery.

It's best to test the battery's electrolyte right after you shut off the engine. All the how-to's you need to test and keep your batteries in full charge are explained in Chapter 3 of TM 9-6140-200-14.



Checking specific gravity is no sweat. Use the optical battery/anti-freeze tester in your Common shop sets.

Then follow the procedures in Para 3-6 of TM 9-6140-200-14.

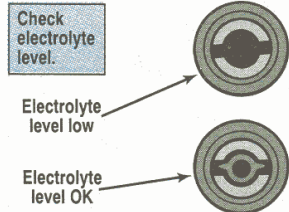
If the specific gravity is less than 1.045, or if the differences between cells is more than 0.025, turn in the battery.

**C**old temperatures sap your vehicle's batteries. Engine oil thickens, which makes parts stiff and slow as molasses. A few cranks on the starter is all it takes to finish off weakened batteries.

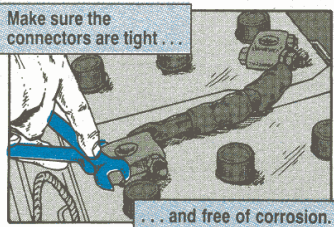
When your batteries are gone, and you have to go, you can slave start your vehicle.

Here's how:

- Get familiar with the slave starting instructions in your vehicle's -10 TM.
- Make sure the electrolyte level in all cells of the batteries is above the plates.

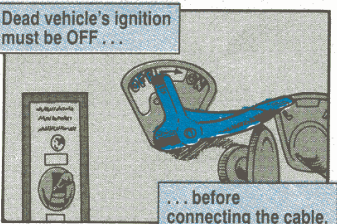
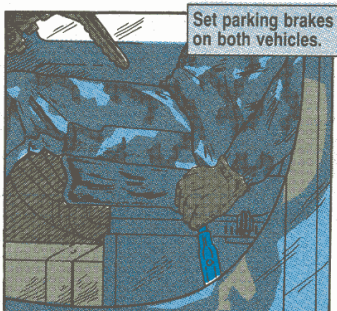
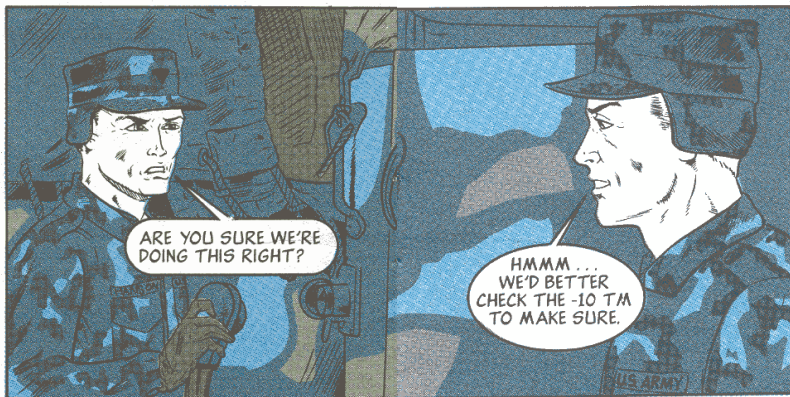


- Make sure battery cables and terminals on the dead vehicle are tight and free of corrosion.

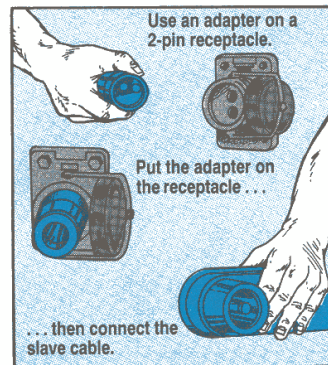


- Set the parking brakes on both trucks. Shift the transmission of each truck to neutral. Keep the live vehicle's engine running.

# Slave Starting Tips



- If either vehicle has the old 2-pin slave receptacle, push the NATO 2-pin adapter on the truck's slave receptacle.
- Always connect the slave cable to the dead vehicle's slave receptacle first. Make sure the connection is good and tight.



- Push the slave cable connector into the slave receptacle on the live vehicle.
- Wait at least 1 minute—but no more than 3—before starting the dead vehicle.
- Try to start the dead vehicle.
- Always step on the clutch pedal if the vehicle has a manual transmission. This helps the vehicle start easier by cutting down on engine drag. If the vehicle fails to start after three tries—stop! The vehicle has problems that slaving won't solve.



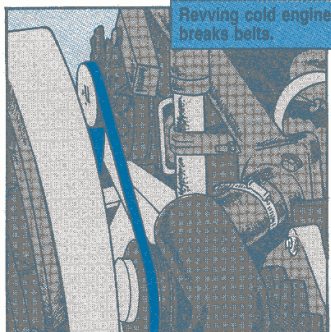
- Keep the cable connected until the vehicle starts. Never unhook a slave cable while the starter is engaged, or you'll see fireworks like the 4th of July.
- Let the engine run at fast idle after it cranks.
- Once you get the dead vehicle started, pull the cable off that vehicle and then remove it from the live one.

# EXTREME PM FOR EXTREME COLD

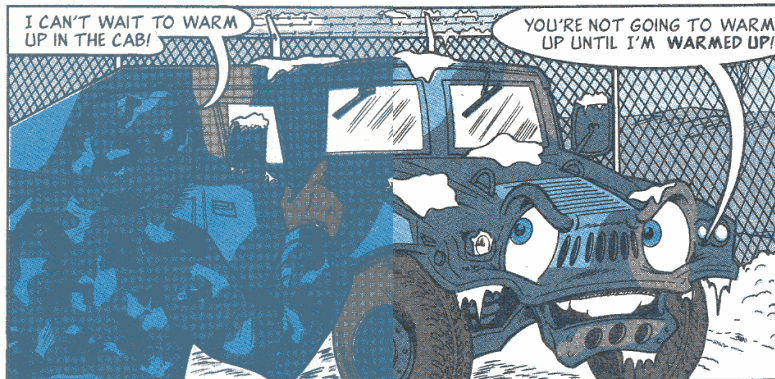
**T**here are several degrees of cold. There's "plain, old ordinary" cold (down to zero), "really" cold (to 10 below) and then there's "extreme" cold—where the thermometer can drop from -10 to -65 degrees like a one-way yo-yo.

If you're in an "extreme" cold weather area, here are a few things you can expect:

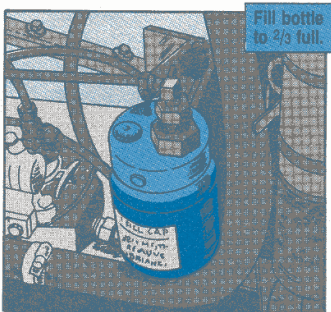
▣ CUCV and HMMWV alternator/generator belts snap in cold temperatures. Keep the belts from breaking by warming them with a 400,000 BTU duct-type heater before starting the engine. Do not rev the engine while it warms up. Keep extra belts on hand.



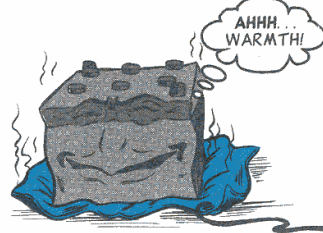
▣ The boom on a 5-ton wrecker "stiffens up" when the hydraulic fluid gets thick. Change the OE to OEA (sub-zero lube) for cold weather operations. Get a 5-gal can with NSN 9150-00-402-2372.



▣ Water left from condensation causes brake systems to freeze solid. An alcohol evaporator keeps moisture from freezing. Eyeball the evaporator bottle daily to make sure it's at least two-thirds full of methyl alcohol. Get a gallon can with NSN 6810-00-597-3608, a 5-gal can with NSN 6810-00-275-6010, or a 55-gal drum with NSN 6810-00-224-8353.



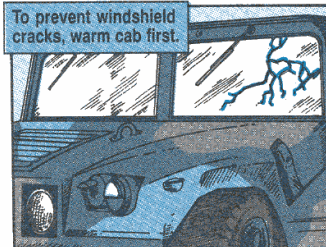
▣ Battery heating pads are the best bet for keeping a battery warm.



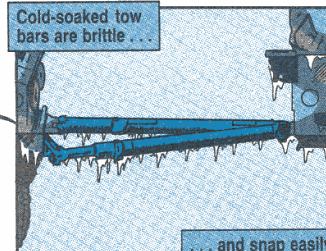
▣ Never apply the parking brake. It will freeze. Instead, chock the wheels of your truck or trailer.

▣ The tires on your equipment freeze to the ground if you don't move your equipment often. Use dry tree limbs, brush, or cardboard under tires when you park. If the tires get stuck, be sure to use a blunt tool to chip them out—don't gouge your tires.

▣ Sudden changes in temperature crack windshields. Help prevent busted windshields by warming the cab with the personnel heater. After the cab's warm, turn the heater defroster on LOW—never throw it on full blast to warm and defog the windshield.



▣ Cold-soaked tow bars, pins, hooks and pintles snap on you. Tubular tow bars and steel cables work a little better, but watch out for sudden bumps and jerks.

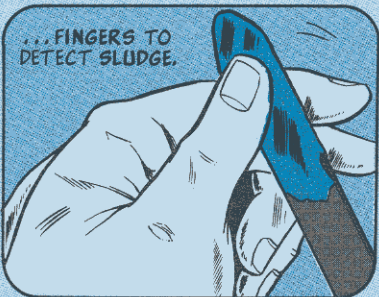


▣ M973 SUSV tracks must be adjusted outside where you're operating. If they're adjusted where it's warm, the track will tighten up and break when it hits the cold.

# Prevent Contamination

If your truck is not under AOAP, it may suffer from oil contamination during winter months. Buildup from condensation and dilution from fuel are the culprits.

## AFTER EVERY DAILY OIL LEVEL CHECK...



Look for bubbles in the oil on the dipstick. That's moisture contamination. If you see bubbles, draw a sample and let it stand in a glass jar. Water will separate from the oil. Oil's lighter than water, so it floats.

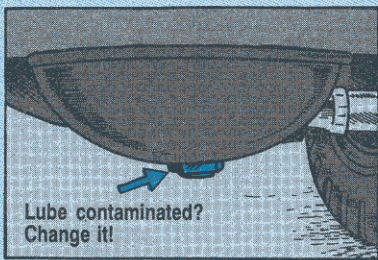
Change the oil and oil filters when you find contaminated oil.

If you're using OEA arctic engine oil, check your oil level every time you shut down and before you start up again. This is because an engine will consume more of this thin oil than OE/HDO.

Keep an eye on the oil pressure gauge. A pressure drop can mean low oil. On long runs, check the oil level several times a day. NEVER overfill to cut or skip oil checks. Overfilling brings on other troubles, like blown seals.

Same goes for the rest of the chassis don't over-lube. Globbs of cold-stiffened grease can cause parts to bind and lock.

Condensation is always knockin' at the door. So, in between your regular lube services, check one or two of your gear cases like a differential, transmission or transfer. Remember, it's time for an oil change when there's oil contamination.



# Exhaust Goes Outside

When you close the doors to your maintenance shop to keep out the cold, you also keep in dangerous exhaust fumes from running vehicles.

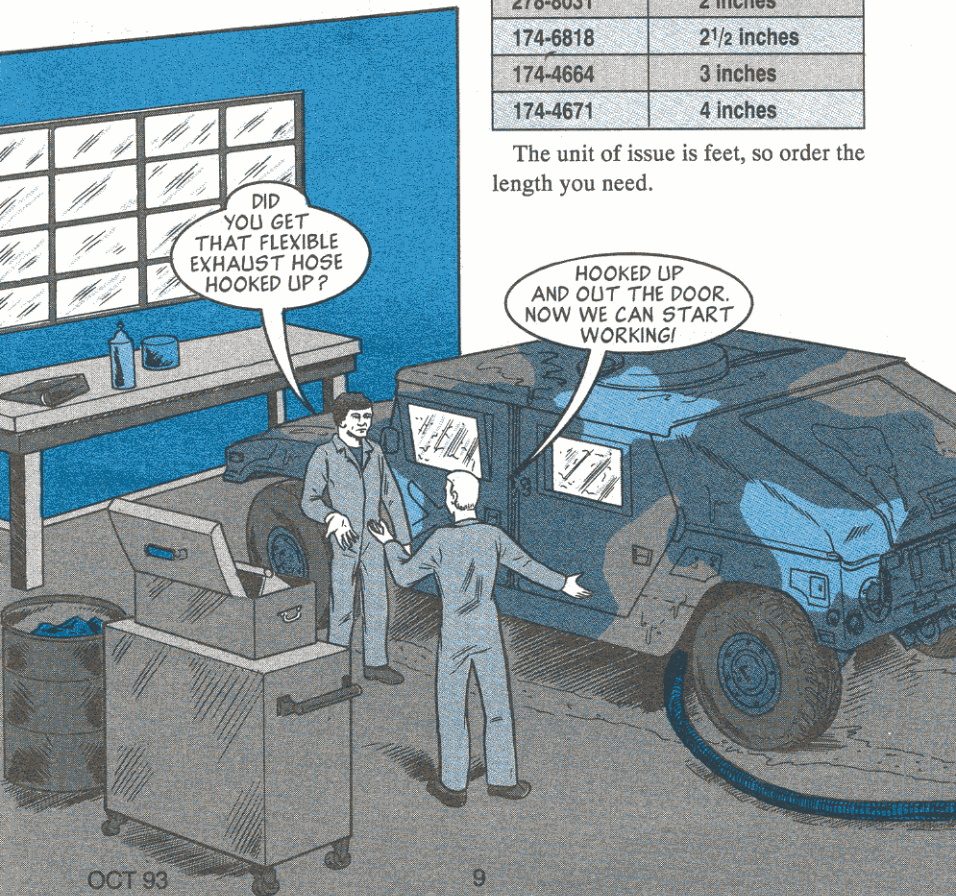
Run that exhaust safely outside by using a flexible exhaust extension.

A snug fit over the exhaust pipe is needed to prevent leaks.

Here is a list of flexible tubes to fit some common-size tailpipes:

NSN 4720-00-	Inside Diameter
174-4668	1 inch
278-8030	1½ inches
278-8027	1¾ inches
278-8031	2 inches
174-6818	2½ inches
174-4664	3 inches
174-4671	4 inches

The unit of issue is feet, so order the length you need.



# WRAP UP



Use chains when you need them, of course. But always remove them as soon as you can. They can damage the drive train and tires.

Keep track of them after they're installed. Chains can break and wipe out a brake line or tear up the vehicle.

## M939A2s, HMMWVs

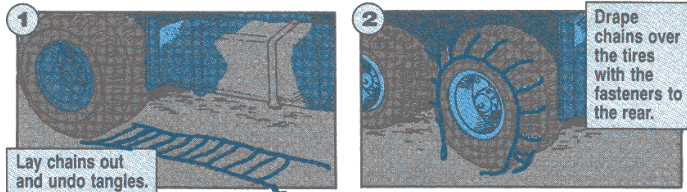
Forget using chains on your M939A2-series 5-tonners since they have the Central Tire Inflation System (CTIS).

The chains can tear up the extra air lines used by the CTIS.

You can use chains on the HMMWV's runflat tires. Be sure to use the chains on all four tires. You risk drive train damage if you install chains only on one axle.

## Putting 'em On

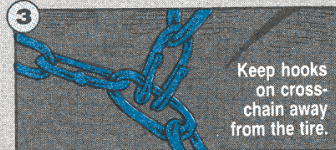
There are several ways to install tire chains. One way is spelled out on Page 19-6, FM 21-305, Manual for the Wheeled Vehicle Driver, like so:



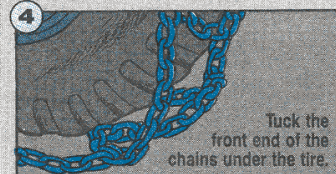
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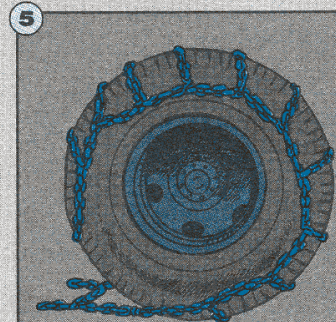
# GO WOES



3 Keep hooks on cross-chain away from the tire.



4 Tuck the front end of the chains under the tire.



5 Drive ahead until the fasteners are at hub level. Fasten the inner chain first... and then the outer. When you've got all your chains installed, drive a short distance and then check for chain tightness.

You can also lay your chains out in front of your vehicle and drive on the chains. Then fasten the chains. Remember, fasteners to the rear, cross-chain hooks away from the tires.

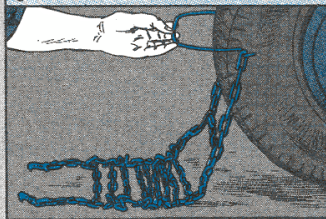
Get chains as tight as you can by hand. Don't use tools. And never let

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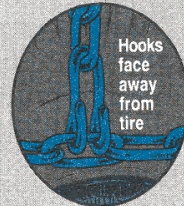
some air out and reinflate the tires after you put chains on. They'll be too tight. Chains need to be able to creep on the tire.

Some people think there's an easier method. You let the wheel put the chain on. It's pretty much like the instructions that come with lot of civilian tire chains which come with a special clip or applicator for hooking one end of your chain to the tire. You can make a clip from some rod or scrap metal. Just make sure it's got a little spring to it so it'll grab hold of the tire.

Hang the end links of your chain on the clip. Press the clip onto the tire at hub level. Pile the chain neatly close to the tire... so it'll peel off when the wheel goes around.



Make sure the cross-chain hooks face up... so they'll face away from the tire when the chain's installed.



Drive ahead until the wheel makes a complete turn. Pull the clip off, connect the chain ends!

11

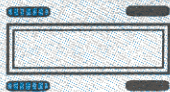
PS MORE



## Chain Positions

Chains in the wrong places won't do much good—and can cause damage. Best for traction, starting and stopping is chains all around, even on non-driven front wheels.

If your vehicle has a non-drive axle, put chains on the drive axle or axles.



If you have only single wheel chains, put 'em on the outside tires on front tandem axles.



If you have a tandem drive rig, but you have chains for only 1 axle, put them on the front tandem axle.



Trailers don't usually get chains, but you may need them if roads are real slick. Put them on the rear axle if the trailer's got tandem axles.



## Maintenance

Check your chains before you put 'em on. You'll save taking them off for repair. Repair any broken or worn cross-chains.

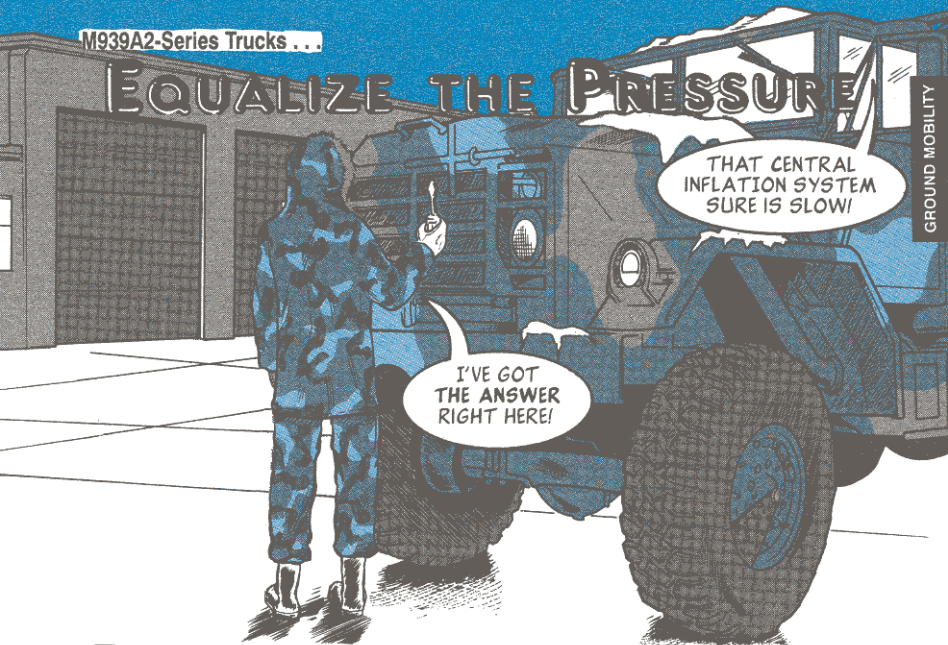
Check your chains before you pull out of the motor pool.

At the end of the season, clean the chains with a wire brush to get off dirt and rust. Soak them in cleaning solvent to loosen stubborn gunk. After cleaning, dunk 'em in used crankcase oil, and drip dry.

STORE THE CHAINS IN BURLAP OR A CANVAS BAG – LIKE THE ONE THEY CAME IN – AND PUT THEM IN A DRY PLACE.



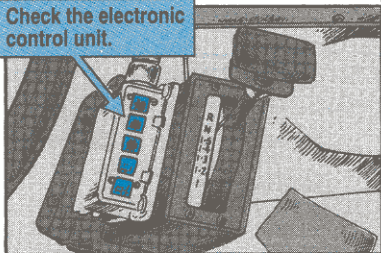
# EQUALIZE THE PRESSURE



The central tire inflation system (CTIS) on these 5-tonners works real slow in sub-zero weather. It takes awhile for the tires to stabilize at a selected tire pressure.

Besides, the electronic control unit keeps blinking its lights at you until tire pressure is set on all six tires.

Check the electronic control unit.

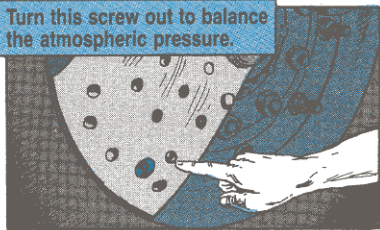


It's the cold air—atmospheric pressure—that causes the problem. Air in the sealed portion of the wheel valve is

warmer than the air outside. This causes slower reaction time. The system tries to inflate or deflate the tires, but the sensors can't get an accurate air pressure reading.

You can solve that problem by using a cross-tip screwdriver to turn out the wheel valve screw. Just turn the screw three times counterclockwise. This helps to equalize the atmospheric pressure inside the tire. Then turn the screw back in during warm weather.

Turn this screw out to balance the atmospheric pressure.



# Prevent Pipe and Faucet Freeze-Ups

Here are some cold weather PM techniques to keep Old Man Winter from freezing the pipes and faucets on your M149, M149A1, M149A2 or M625 400-gal water tank trailer.

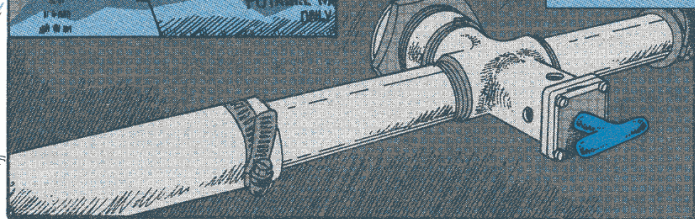
- Place the water tank trailer in a shelter, especially if the temperature is below 0°F. A warm tent — where there's a field range operating — is best. If a shelter's not available, cover the trailer with canvas and keep warm air circulating with a Herman-Nelson heater.

- Always keep the manhole and filler covers tightened. That keeps the water heat in the tank and freezing cold air out!

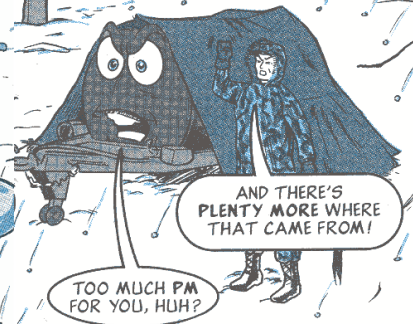
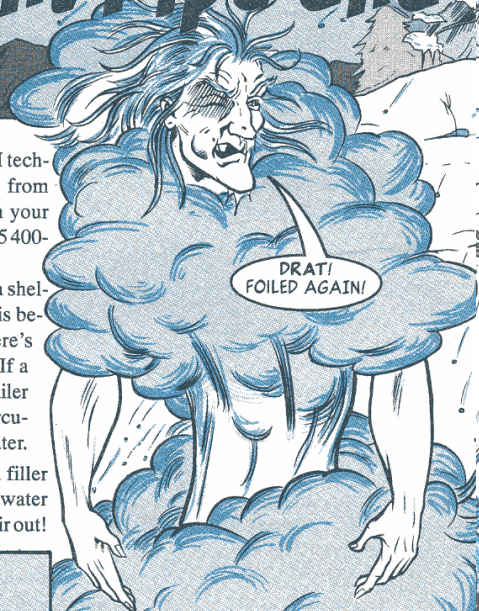
Keep the manhole cover tightened.



Shut off the water with T-valve.



- After each use, drain the pipes by shutting off the water with the main T-valve in front of the tank. Then open all faucets. Prop them open with a piece of wood. No water — no freezing!



- Use an immersion heater only in the metal tank. Never use it in the fiberglass tank. Heat will melt fiberglass.

The best immersion heater for the job is NSN 4540-00-266-6834. It has a steel disk that's used as a cover for the tank and a support for the heater assembly. The heater's in Chapter 5 of TM 10-4500-200-13.

If you already have an M67 immersion heater, use it. Just follow the instructions on Pages 2-18 through 2-20 of TM 9-2330-267-14&P (Jul 91) to adjust the heater bracket to make it fit the tank.

## Engines ...

### Stay Away from Ether Cans

Spray can ether is a no-no for starting diesel and multifuel engines in cold weather! That's the word from the headshed.

Ether can cause cracked pistons, bent rods and ruined heads. The engine is ruined.

Some engines have starting aids built right in; others don't. Whether yours does or doesn't, never use spray can ether.



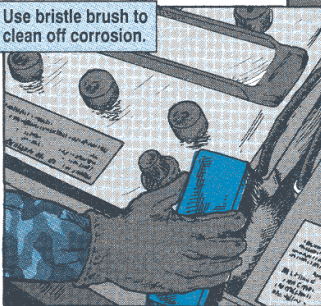
# Battery Care's the Same for Most

**M**echanics, corrosion has a way of sneaking up on the lead-acid batteries used in combat and tactical vehicles. Treat it quickly, or it'll take over before you know it.

With the exception of the coating used for MLRS battery boxes, treating corrosion problems is the same for all vehicles. Just follow these steps:

- ❖ Make sure you wear all required safety gear—including goggles, gloves and an apron.
- ❖ Remove the batteries and scrub them with a bristle brush and a solution of 1/2 pound of

Use bristle brush to clean off corrosion.

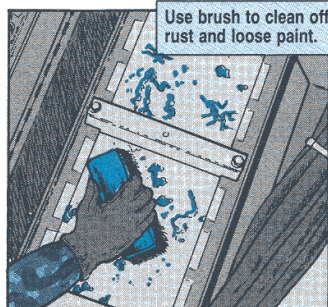


baking soda, NSN 6810-00-264-6618, in a gallon of water.

- ❖ Keep the battery filler caps screwed in tight while you scrub. This keeps baking soda out of the battery where it can neutralize the acid in the electrolyte. Rinse off any remaining soda solution with lots of clean water.

- ❖ Scrub any corrosion in the battery box with the baking soda mixture and a brush to get rid of loose paint and rust.

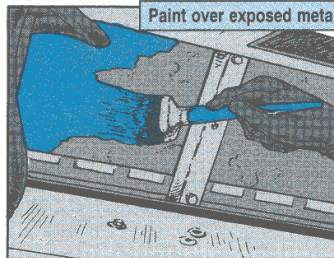
Use brush to clean off rust and loose paint.



Get down inside the box and scrub everything, especially the corners where corrosion hides. Rinse with lots of water and then dry everything completely.

- ❖ Touch up the bare spots on the battery box before putting the batteries back in. Use either epoxy primer, NSN 8010-00-082-2450, or bituminous, NSN 8030-00-290-5141, whichever one was last used on the box. If you switch from one to the other, sand off all the old stuff before you put on the new.

Paint over exposed metal.



For the MLRS battery box, use either epoxy primer, NSN 8010-00-082-2450, or zinc chromate primer, NSN 8010-00-515-2208, and follow the instructions above. Then, paint over the primer with polyurethane coating, NSN 8010-01-162-5578.

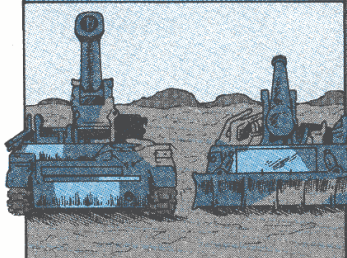
# Safe Slaving's the Way to Go

SLAVE-STARTING YOUR TRACKED VEHICLE DEMANDS CARE. YOU CAN BE SERIOUSLY INJURED OR KILLED WHEN SLAVING.

THE KEY TO SLAVING IS SAFETY... IN POSITIONING, PREPARATION, CHARGING, STARTING AND DISCONNECTING.

## Positioning

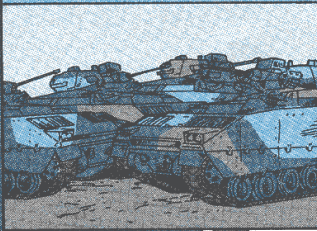
**1.** Park self-propelled howitzers and M992 ammo carriers side by side, facing in opposite directions.



**2.** For tanks and all other tracked vehicles, park them side by side, facing in the same direction.



**3.** When the vehicle you want is sandwiched between other dead vehicles, put the live one in front of and at right angles to the dead vehicle.



IT'S THE ONLY WAY TO GO!

Never put a live vehicle head to head with a dead one. Somebody could get hurt if either vehicle jumps ahead.

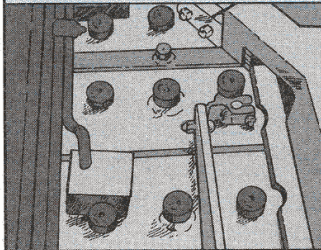
Safe slaving means thinking things out first. Study the slaving info in your -10 TM before you begin, and always have a ground guide overseeing the operation. Those extra pair of eyes can save lives.

The following tips apply to all combat vehicles except M1-series tanks:

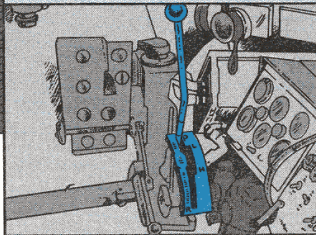
## Getting Ready

There are three things you must do before you hook up the slave cable.

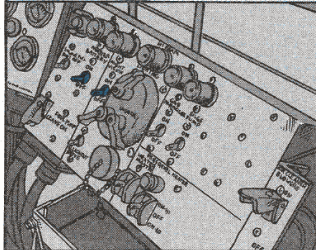
**1.** Check the batteries of the dead vehicle for damage. Is the electrolyte level OK? Are the cables, leads and ground straps tight and firm? Get your mechanic on the scene to make any needed repairs.



**2.** Make sure both vehicles are in PARK. Put M109s and M992s in NEUTRAL.



**3.** Make sure the parking brake is set and the master switch and all electrical and electronic equipment switches in both vehicles are OFF.



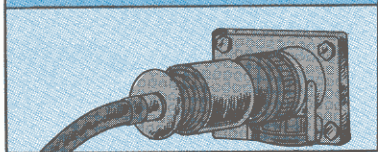
SEE THE NEXT PAGE TO HOOK UP WITH MORE SLAVING INFO!



FIREPOWER

## Charging

**1.** With master switches in both vehicles OFF, attach the slave cable securely to the dead vehicle first, then to the live one.



**2.** Charge the batteries in the slaved vehicle for 15 minutes by starting the live vehicle and setting the engine idle to 1,000-1,200 RPM.

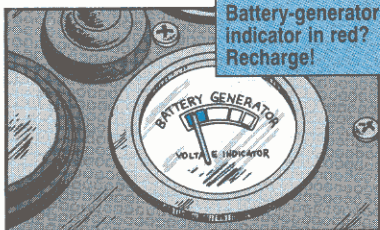
## Starting

Ready to start?

**1.** Run the engine in the live vehicle at normal idle with the master switch OFF. Turn the master switch in the dead vehicle ON and press the start button.

**2.** If the vehicle starts, get the engine running smoothly, then turn the master switch OFF.

**3.** If it doesn't start within 15 seconds, release the start button.



If the needle's in the red, recharge the batteries and try to start again. If the needle's in the yellow or green, wait 3-5 minutes and start again.

**4.** Do not grind the starter for more than 15 seconds at a time or you'll burn it up. If your vehicle won't start after three tries, call in your mechanic.

## Disconnecting


Once the dead vehicle has been started and is running OK, you've still got to be careful disconnecting the slave cables.

**1.** Switch the master switches in both vehicles OFF before you remove the cables. If you don't, you may damage the slave cable connectors and your electrical systems.

**2.** Once the cables are disconnected, turn the master switches on again. Run both engines at 1,000-1,200 RPM to stabilize generators and build up run-down batteries.



# Too Hot to Handle



MOVE OVER, GUYS,  
IT'S WAY TOO HOT AROUND  
THIS HEATER FOR YOU!

THANKS, BOSS!  
I WAS ABOUT TO BLOW  
MY TOP!

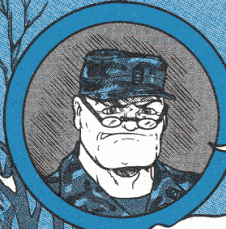
**W**arm just about any part of your body you like in front of the outlets of your vehicle's personnel heater. But never, ever store loose items like field jackets, gloves, aerosol cans, TMs, ammo bags or anything else that can burn near them.

The air temperature at the outlets can reach nearly 300°F when the heater is running on HI. That's plenty hot enough to burn most everything in a combat vehicle. And it's definitely hot enough to burn combustible items.

Don't be among the many who've learned the hard way — from fires or explosions that could've been prevented.

# THE WAY TO A

# COLD, COLD START



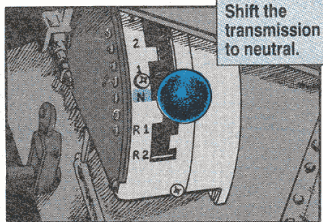
DRIVERS, COLD WEATHER CAN BE A BITTER EXPERIENCE IN MORE WAYS THAN ONE WHEN TRYING TO START YOUR M992 AMMO CARRIER OR M109 HOWITZER.



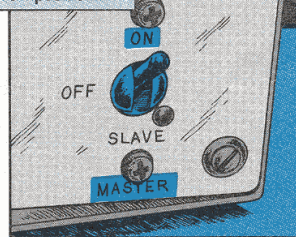
I WISH HE'D LEARN TO START ME THE RIGHT WAY IN COLD WEATHER!

The "Operation Under Unusual Conditions" section of both -10 TMs is a little out of date. So, until it's changed, follow these instructions to a successful cold start:

1. Secure the winterization kit and shut off the COOLANT HEATER switch.
2. Make sure the battery indicator gauge is in the green range.
3. Set the parking brake and shift the transmission to neutral.



Master switch to ON position.



or the engine will return to idle once it's released.

5. Turn the FUEL PRIME switch ON for 45 seconds, then release.

6. Set the hand throttle to IDLE. Do not use the foot throttle.

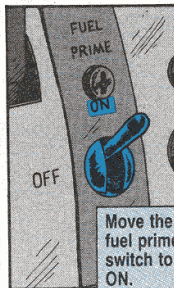
Now you're ready to start the vehicle:

1 Pull out and hold the FUEL SHUTOFF handle.

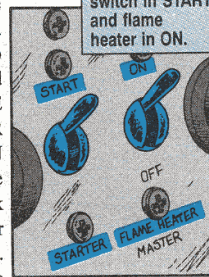
2 Push the STARTER switch to START and the FLAME HEATER switch to ON at the same time. Crank the engine for 15 seconds. Release the FUEL SHUTOFF handle.

3 Keep cranking the engine while setting the FLAME HEATER switch ON one second and OFF one second until the tachometer reads at least 300 RPM.

4 Let go of the FLAME HEATER switch. Keep cranking until the tachometer reads at least 500 RPM. The hand throttle may be increased about 1/8 travel to help start once 500 RPM is reached. DO NOT use the foot throttle



Put the starter switch in START and flame heater in ON.



5 Stop cranking if the engine hasn't started after two minutes, or you may burn up the starter. Wait at least two minutes, then start over with step one. If the engine still won't start or doesn't reach 100 RPM or more after 15 seconds, get your mechanic.

6 Release the starter switch after the engine starts and follow the engine warm-up procedures in the -10 TMs.

## Before Shutdown

Just before shutdown, run the engine at idle and turn ON the FLAME HEATER switch. If the heater is working okay, you'll see a slight decrease in engine speed and an increase in exhaust smoke. If not, call your mechanic.

Testing the flame heater also ensures fuel is in the fuel supply line the next time you start your vehicle.

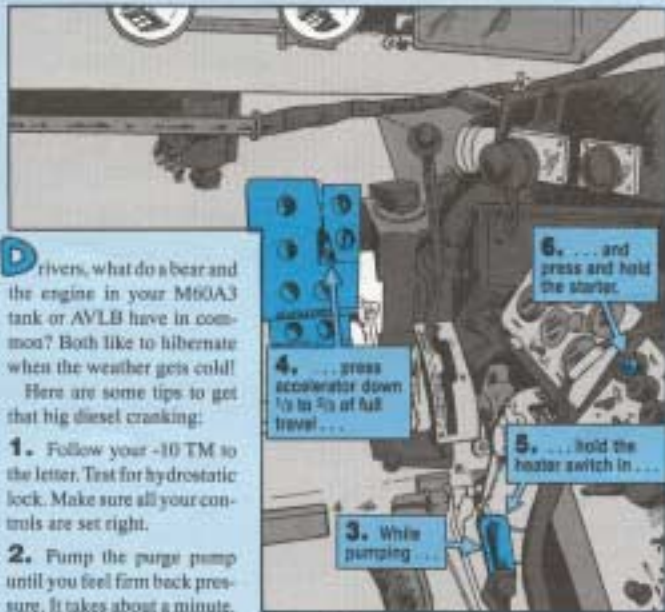
To increase the chances of an easy start the next time the thermometer takes a nosedive, have your mechanic install cold start enhancement kit, NSN 2990-01-342-7944.

The kit maintains 11/2 PSI of positive pressure in the fuel lines. That prevents loss of prime in the flame heater fuel supply line when the engine is not running.

Until the parts manuals are updated, use Appendix A of CTA 50-970 as your authority for ordering the kit. The kit will only work with the M992 ammo carrier and M109A2/A3 howitzers.



# The Truth About



**D**rivers, what do a bear and the engine in your M60A3 tank or AVLB have in common? Both like to hibernate when the weather gets cold!

Here are some tips to get that big diesel cranking:

1. Follow your -10 TM to the letter. Test for hydrostatic lock. Make sure all your controls are set right.
2. Pump the purge pump until you feel firm back pressure. It takes about a minute.

3. While pumping ...
4. ... press accelerator down  $\frac{1}{2}$  to  $\frac{3}{4}$  of full travel ...
5. ... hold the heater switch in ...
6. ... and press and hold the starter.

# Cold Starting

**7.** If the engine starts, keep pumping the purge pump with steady strokes, holding the manifold heater switch and the engine starter button until the tachometer reads 450–500 RPM.

Once the engine is running smoothly at about 700 RPM, stop pumping. Release the heater manifold switch and starter button, and increase RPM to 1,000–1,200 for the warmup period.

During warmup and afterwards, don't idle at less than 700 RPM. Low idling causes engine cooling, not heating. When you idle your engine for long periods, idle at 1,500–1,600 RPM.

If you must idle at a lower speed, watch the exhaust. If you see white smoke, increase the RPM to 1,500–1,600. If the engine misfires or blows heavy blue-white smoke, you'll have to blow out the induction and exhaust systems.

To do that, increase RPM to 1,600–1,800 for about 30 seconds to one min-

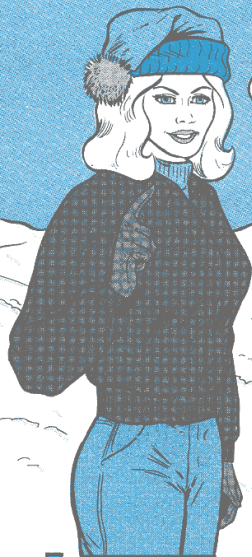
ute. **CAUTION:** Stop the engine fast if the power plant warning light comes on.

If the engine won't start, stop cranking after 15 seconds. Wait three to five minutes and try again. If it still won't start, don't grind away on the starter. It'll burn up and then the engine definitely won't start.

FOLLOW THE -10 TM TROUBLE-SHOOTING PROCEDURES TO GET THE TRACK STARTED. IF THAT DOESN'T WORK, CALL YOUR MECHANIC.

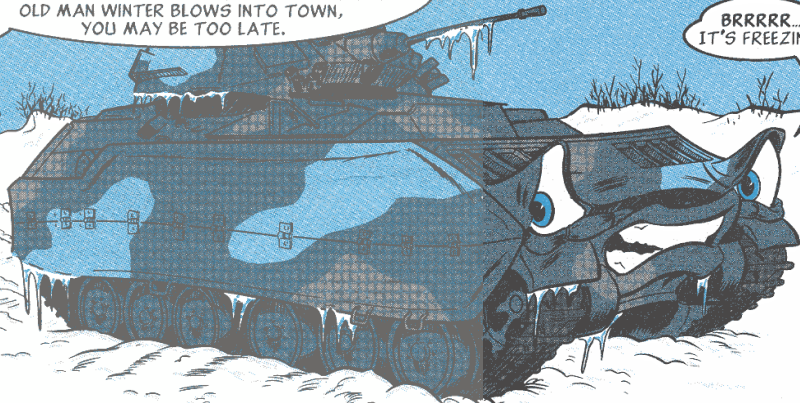


# Some Like It Hot!



WITH WINTER COMING ON, CHECKING YOUR VEHICLE'S PERSONNEL HEATER SHOULD BE THE HOTTEST THING ON YOUR LIST. IF YOU WAIT UNTIL OLD MAN WINTER BLOWS INTO TOWN, YOU MAY BE TOO LATE.

BRRRRR... IT'S FREEZING!



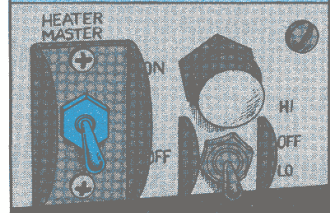
If you have a Stewart-Warner heater, Model 10560G, C or M, and it doesn't work, cycle the start switch two minutes on, 10 seconds off. This keeps the ignition control from getting too hot.

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 between 10 and 12 volts. A reading below nine volts and visible hot spots are signs of a shorted igniter. Replace it. If you still don't get the required 10-12 volts, let support check it out.

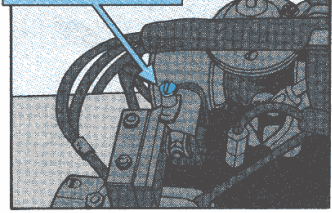
While the cover is off, check the flame detector switch. On newly installed Stewart-Warners, the flame detector switch may need adjusting.

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



Make sure the heater is off and cool, then turn the adjustment screw counter-clockwise part way. Slowly turn in until the switch clicks. When you hear the click, turn the screw 1/2 turn clockwise. Apply sealant, NSN 8040-00-225-4548, around the screw head to keep it from moving.

Put sealant around the adjustment screw.



## Hupp Heaters

Your Hupp MF510B, MF510C, MF60A-24V and MF60B-24V heaters start differently.

Let the 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 off, 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 right, 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.

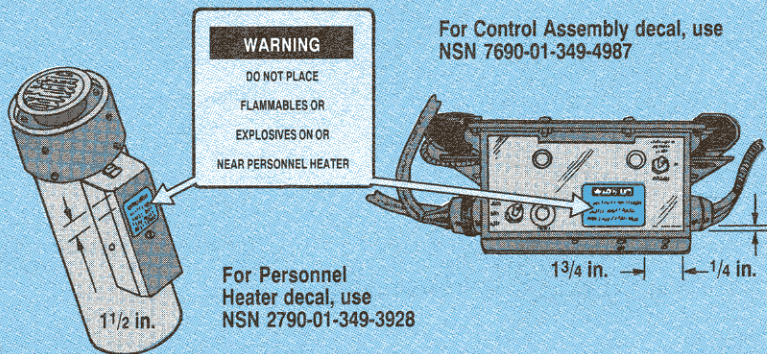
Give your heater a chance to purge itself at shutdown. Some vehicles have electrical circuitry that lets the heaters run and purge themselves even with the master switch off. Others have to run until purging is finished before you hit the master switch.

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

For more information on personnel heaters, check out TM9-2540-205-24&P (Apr 92).

# Get 'Em While They're Hot

Warning decals for the personnel heater and control box assembly in your M109-series howitzer and M992 ammo carrier are still available. Here they are:



Take a clean rag and wipe the surface with general purpose cleaner, NSN 7930-00-515-2477, and let it dry before putting the decals on.

M992 Ammo Carrier . . .

## Use Only Hupp






**Y**our M992 ammo carrier's -20P TM gives you an option of using either a Hupp or a Stewart-Warner heater. But that's wrong! Use only the Hupp model MF510C or MF60B heater, NSN 2540-01-162-3834, in your carrier. If your vehicle has a Stewart-Warner heater, replace it with a Hupp heater.

Combat Vehicles . . .

# Prepare For Winter Now!

A bad igniter or glow plug is the most common problem with combat vehicle personnel heaters. Replace bad ones now before Old Man Winter blows into town.

HERE'S A HANDY CROSS-REFERENCE OF  
IGNITER/GLOW PLUG-TO-HEATER MODEL . . .

Heater	Igniter/Glow Plug NSN	
Stewart-Warner 10560C, 10560G, 10560M, 10560M24B1	4520-00-217-5782	
Hupp MF510B Hupp MF510C, MF60A-24V, MF60B-24V	2540-01-115-1805 2540-01-167-7248	
ESPAR V7S	2540-12-167-3599	

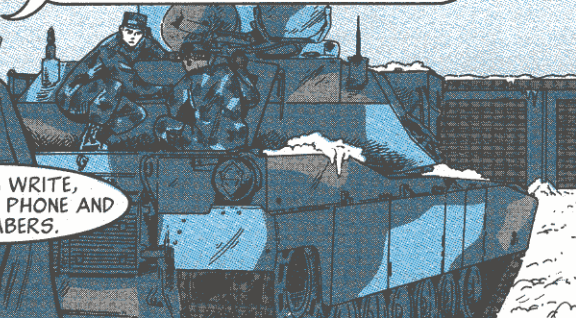
FIREPOWER

## New Address for PS

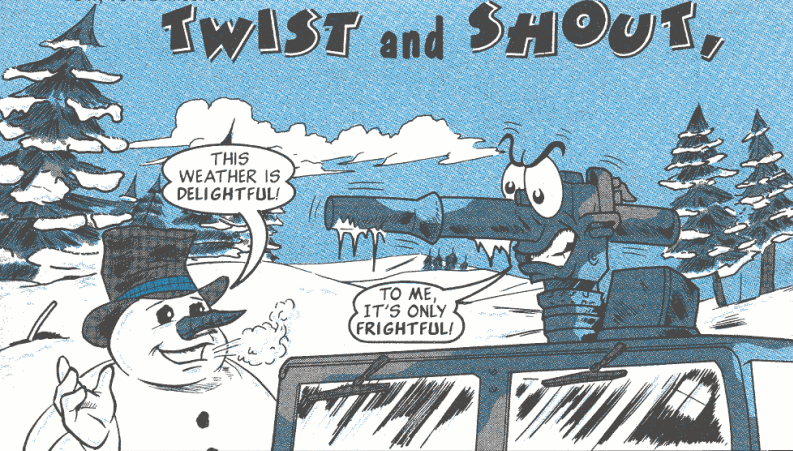
IF YOU NEED HELP WITH A  
MAINTENANCE OR SUPPLY PROBLEM,  
WRITE TO PS AT OUR NEW ADDRESS . . .

**THE PREVENTIVE MAINTENANCE MONTHLY  
BLDG. 3325  
REDSTONE ARSENAL, AL 35898-7466**

WHEN YOU WRITE,  
GIVE US YOUR PHONE AND  
FAX NUMBERS.



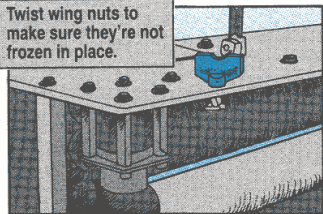
# TWIST and SHOUT,



Your TOW's going to need a little extra help in cold weather.

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

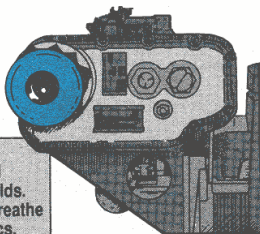
Twist wing nuts to make sure they're not frozen in place.



Your repairman should also order extra wing nuts, NSN 5325-01-148-8601, and retainer rings, NSN 5365-00-298-6564.

Rubber eyeshields on the optical and night sights freeze, collect ice and eventually crack. That leaves the delicate optics vulnerable to ice and snow. Tell your repairman if eyeshields, NSN 5855-01-070-4072, are cracked.

Report cracked eyeshields. Don't breathe on optics.



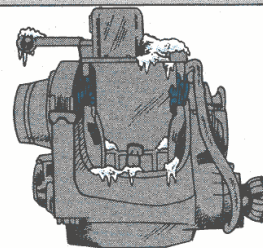
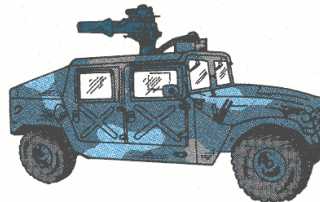
Don't breathe on optics in cold weather, either. That will fog and ice them. Extreme cold causes distortion for the AN/TAS-4A night sight when cold hits the heat rising from the vehicle

# BUT DON'T BREATHE!

engine on mounted TOWs. Beat distortion by positioning your vehicle so you're aiming away from the engine.

Keep clamping surfaces on the traversing unit, sights, and missile clear of snow and ice.

Point TOW away from engine.



Snow and ice can cause a poor electrical connection.

M29, M252 Mortars ...

## Check the Sabot Nut

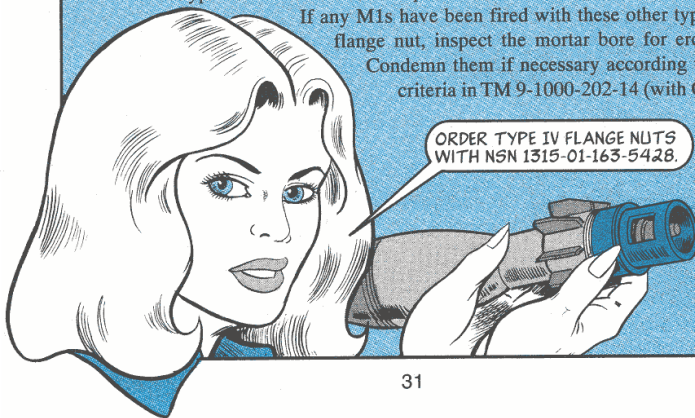
Before you train with your M29 or M252 mortars, armorers, eyeball the flange nut assemblies on the 81MM M1 Sabot training rounds.

If the round doesn't have a Type IV flange nut assembly, don't use it. The other types of assemblies cause rapid erosion around the mortar firing pin.

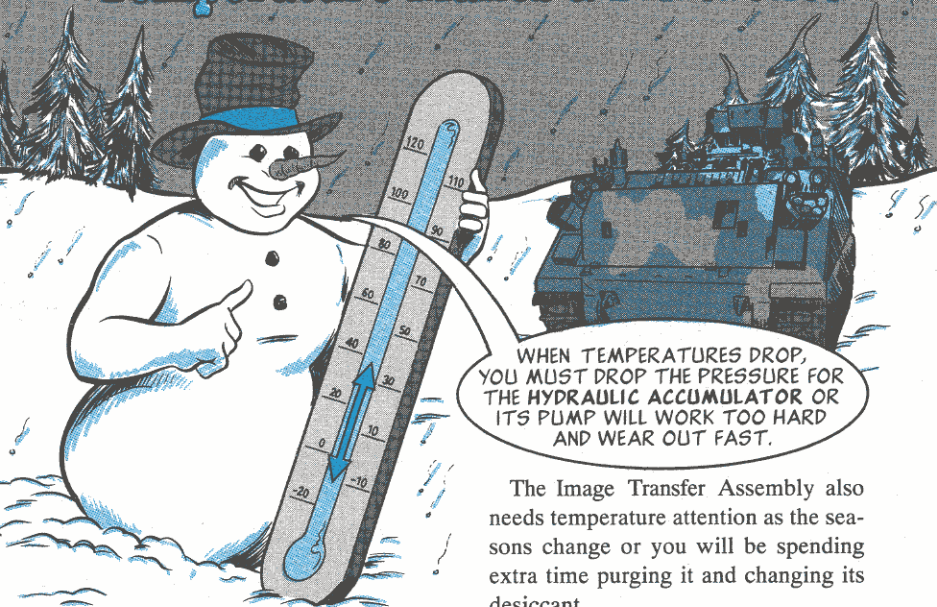
If any MIs have been fired with these other types of flange nut, inspect the mortar bore for erosion.

Condemn them if necessary according to the criteria in TM 9-1000-202-14 (with Ch 7).

ORDER TYPE IV FLANGE NUTS WITH NSN 1315-01-163-5428.



# Temperature Makes a Difference



WHEN TEMPERATURES DROP, YOU MUST DROP THE PRESSURE FOR THE HYDRAULIC ACCUMULATOR OR ITS PUMP WILL WORK TOO HARD AND WEAR OUT FAST.

The Image Transfer Assembly also needs temperature attention as the seasons change or you will be spending extra time purging it and changing its desiccant.

Use this — also an update to the TM — for the ITA:

**K**eeP track of temperature changes of more than 50°F, especially as the seasons change. Adjust the accumulator's pressure according to the chart. This chart is an update to the one in TM 9-2350-259-20:

Temp (F)	PRESSURE (PSIG)
Below 0	825
0-40	900
40-80	1,000
80-120	1,050
Above 120	1,125

Temp (F)	PRESSURE (PSIG)
Above 110	4
85-110	3
55-85	2
30-55	1
5-30	.5
Below 5	0

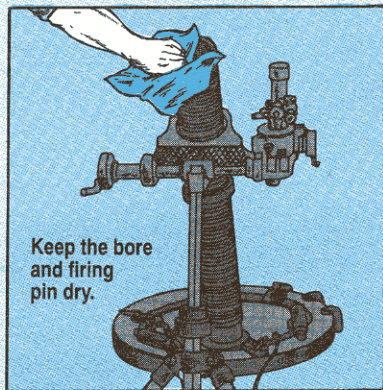
Before you charge either the hydraulic accumulator or ITA, purge the charging lines by blowing pressurized nitrogen through them. That removes any contamination in the lines.

# High and Dry

Your mortar needs some special attention in cold weather.

Lube with LAW instead of GPL, NSN 9150-00-231-2361, when the temperature drops below 10°F. LAW does not get as stiff as GPL in cold weather.

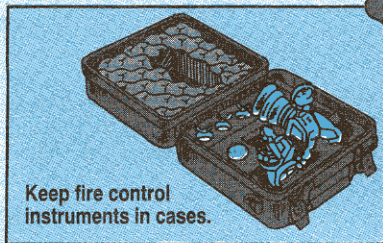
Wipe the inside of the bore dry before you go into the cold.



Keep the bore and firing pin dry.

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

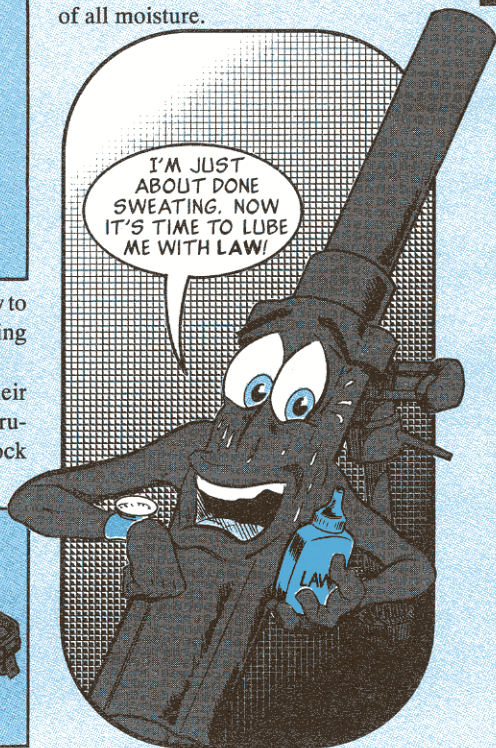
Keep fire control instruments in their cases. The cases cushion the instruments' delicate optics against the shock of the cold.



Keep fire control instruments in cases.

Never bring fire control instruments directly from the cold into a warm place. That cracks optics and lets condensation form inside the instruments. Leave the instruments someplace sheltered but unheated where they can gradually warm before you bring them inside.

When you bring your mortar inside from the cold, wait at least an hour before cleaning and lubing it. By then the mortar will have stopped sweating from condensation and you can get rid of all moisture.



# FIGHTING THE COLD WAR

Gold weather will stop your rifle or machine gun cold if you don't play it cool with PM. Use these PM weapons to fight the cold war:

H-H-HOW DO-O  
YO-OU STA-AY SO-O  
WAR-R-M?

- ☑ Use Rifle Bore Cleaner, NSN 6850-00-224-6663, to remove carbon and LAW, NSN 9150-00-292-9689, to lube your weapons when temperatures drop below 10°F.

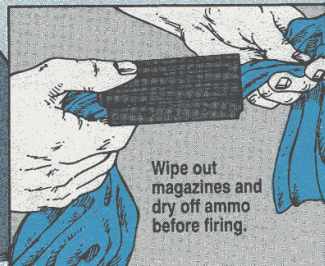


LAW helps moving parts slide better in cold than CLP or LSA. (The exception is the M249 machine gun. It needs CLP in all weather.)

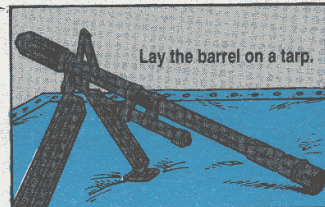
- ☑ Prevent condensation from forming inside weapons by keeping them covered

# FIGHTING THE COLD WAR

- ☑ 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.

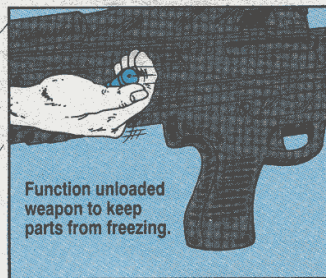


- ☑ Never lay a hot weapon or barrel on the snow. Use a tarp or poncho to lay it on.



when you move from cold to warmth. That lets the weapon warm gradually.

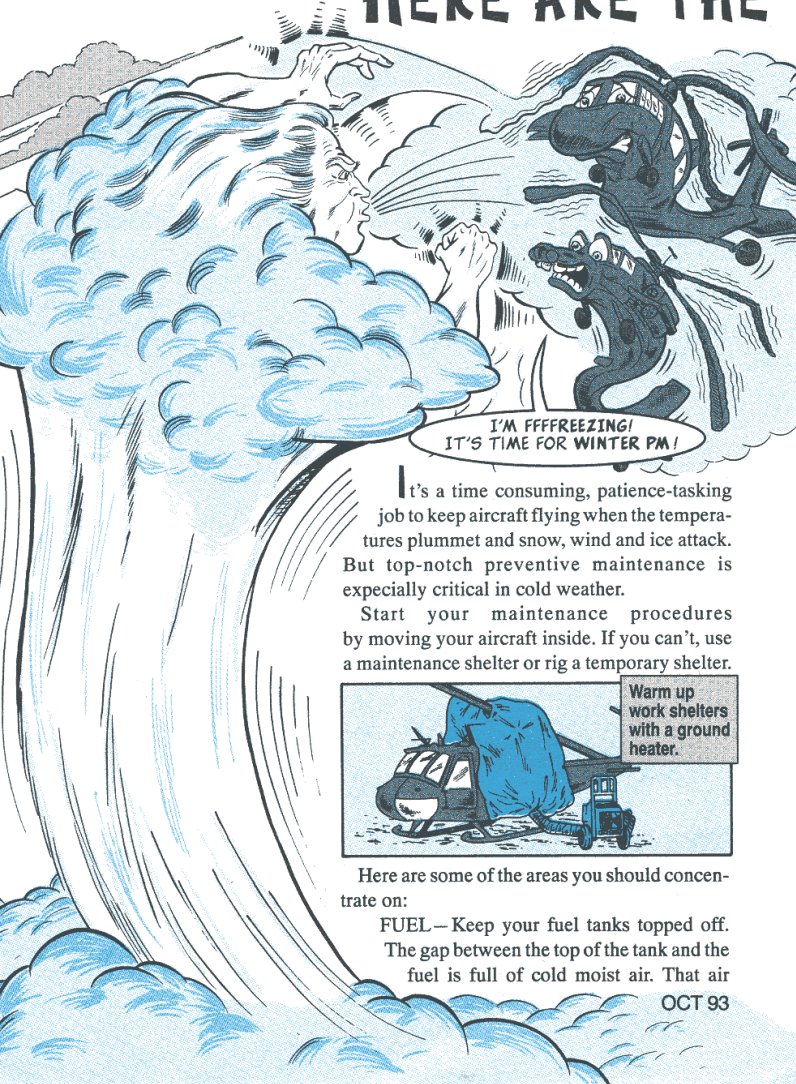
- ☑ Hand function the weapon every 30 minutes to keep parts from freezing solid. If parts do freeze, move them slowly and easily until they move smoothly again. That way you won't break parts.



- ☑ 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 keeps ice and snow away from the barrel, sights and working parts.
- ☑ Wait until a weapon warms to room temperature before cleaning it. The 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.

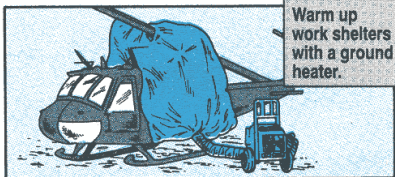


# HERE ARE THE COLD FACTS



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

Start your maintenance procedures by moving your aircraft inside. If you can't, use a maintenance shelter or rig a temporary shelter.



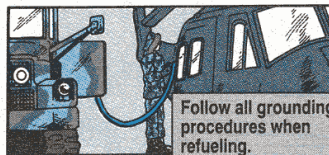
Here are some of the areas you should concentrate on:

**FUEL**—Keep your 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. Drain enough fuel daily to get rid of all the water.

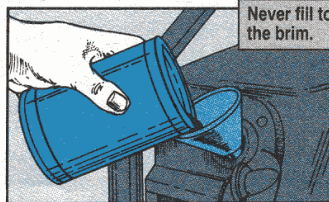
Static electricity is a hazard.

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. Follow all your grounding procedures and take no shortcuts.



**OIL AND GREASE**—Most fluids get stiffer as temperatures fall; oil thickens and grease gels. The lube chart in your TM lists the oil and grease to use.

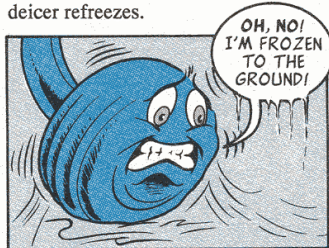
When you service an oil tank, never fill it to the brim. Otherwise, when the oil heats up, the tank will overflow.



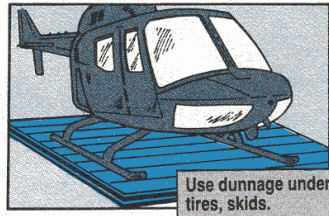
Oil leaks are a chronic problem in cold weather. Check connections, joints and seals regularly.

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

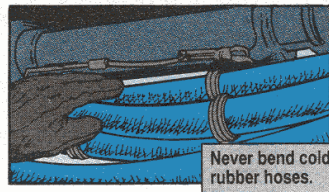
Tires frozen to the ground can be freed with liquid deicer. Move the aircraft immediately to keep it from freezing down again as the slush formed by the deicer refreezes.



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

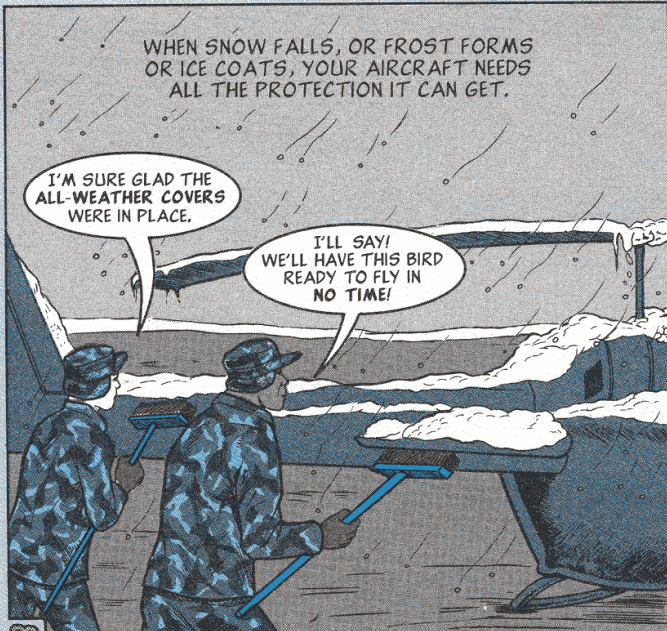


**RUBBER HOSES OR RUBBER COVERED WIRES**—Never bend when they're cold soaked. Rubber gets brittle and stiff and could crack.



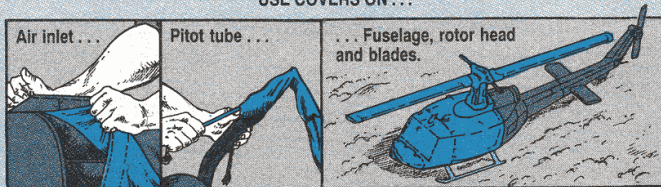
# The Way to Go...

# ...in Frost, Ice & Snow



**U**se the standard covers at the engine air inlet and exhaust, and the pitot tube. If you have all-weather covers, use 'em. Put the covers on when your aircraft is dry; otherwise, they'll freeze in place. If a cover does freeze on your aircraft, loosen an edge and use heat from a ground heater to melt it loose.

### USE COVERS ON ...



Coating your aircraft when frost or ice is heading your way is also a good idea. Coat with anti-icing and defrosting fluid. NSN 6850-00-558-1248 brings a 55-gal drum; NSN 6850-00-901-0591 gets a 5-gal can. Spread the fluid on all surfaces except wiper blades and glass windows.

Coat the aircraft late in the day. If it rains, coat it again. Coat it even if you're using covers. The coating will prevent the covers from sticking.

Coat the blades and glass windows with isopropyl alcohol. NSN 6810-00-855-6160 brings a 5-gal can.

If you've missed the weather report and your aircraft is covered with ice or frost, spray the aircraft with anti-icing fluid. If you can, dilute and heat the fluid. Heated fluid makes ice removal faster. Diluted fluid saves bucks. Table 2-3 of TM 55-1500-333-24 gives the dilution percentages. Para 2-23c gives heating instructions.

If it's just a light coat of frost you're facing, defeat it with a spray of cold, undiluted anti-icing fluid.

Never use water—hot or cold—to clean a windshield. Hot water will crack a windshield. Cold water will freeze. De-ice glass windshields and blades with isopropyl alcohol.

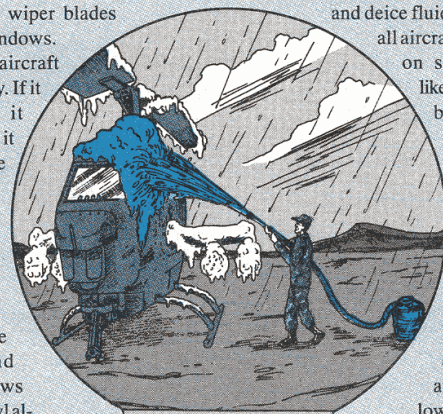
Remember, though, not all anti-icing and deice fluids are good for all aircraft. Some areas on some aircraft, like Teflon-lined bearings, need special treatment. Read your aircraft TM.

Each one has a section on deicing.

Also, remember all deicing fluids are toxic. Follow all safety precautions in the TMs and any local environmental restrictions.

When snow is coming, the only real protection is to cover your aircraft. If you can't cover it, grab a broom and sweep the aircraft during snowfall to keep accumulation down.

Don't use the anti-icing fluid to protect against snow. The fluid is diluted by the melting snow and the diluted solution forms a slush that freezes into a hard coating; or worse, the slush can ooze down into the controls and freeze there.

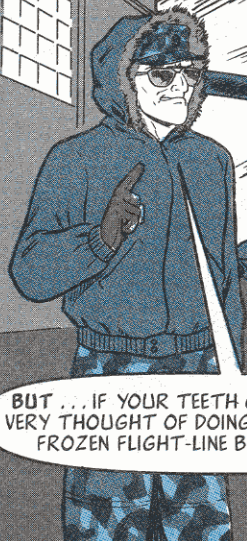


Covered with ice?  
Spray with anti-icing fluid.

Don't Be . . .

# THE CREW CHIEF WHO CAME IN FROM THE COLD

IF YOU'RE WARM AND COMFORTABLE AND ALL  
YOUR BIRDS ARE ROOSTING IN HANGARS,  
YOU CAN STOP READING RIGHT HERE.



**BUT . . . IF YOUR TEETH CHATTER AT THE  
VERY THOUGHT OF DOING MAINTENANCE ON  
FROZEN FLIGHT-LINE BIRDS, READ ON.**



## Rule One

Dress like a five 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.

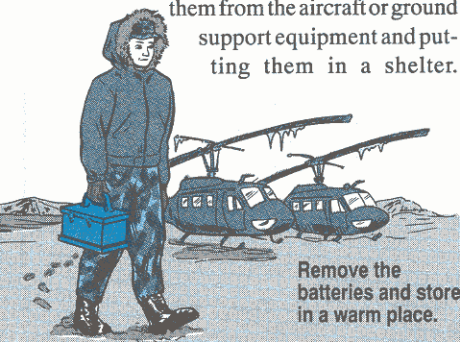
# WARM IS A WINNER

CHARGE UP  
YOUR BATTERY P.M.  
WITH THESE TIPS . . .

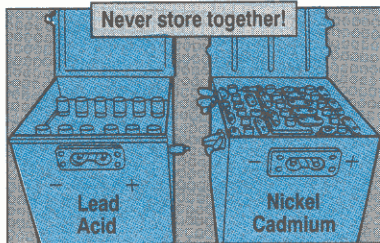


**E**ven though your bird's nickel-cadmium battery performs well in cold weather—it'll start the engine below  $-22^{\circ}\text{F}$ —you should keep it warm. Lead-acid batteries should also be kept warm because they can lose up to 50 percent of their charge in cold weather.

Keep the batteries warm by removing them from the aircraft or ground support equipment and putting them in a shelter.



Never store lead-acid and nickel-cadmium batteries in the same shelter,



though. Fumes from the lead-acid battery will cause total discharge of the nickel-cadmium battery, whose cells will then have to be replaced.

Place the batteries on a shelf or dunnage—never on the bare floor. This will give you a more equalized battery temperature.

If it's not possible to remove the battery from the aircraft, turn on the landing light, search light or other equipment for 30 seconds prior to engine start. The "load" will warm up the battery internally. A warm battery will give you good cranking power and a good spark to head off the possibility of a hot engine start.

Remember, also, you can assist the aircraft battery by using an auxiliary power unit to crank up the bird.

Cold weather also affects the aircraft fire extinguisher. If the temperature is below  $40^{\circ}\text{F}$ , the pressure decreases and the extinguisher won't work right.

Protect your aircraft from severe weather. Covers—canopy, airframe, engine, rotor blade, pitot tube . . . use all of 'em!

# Dry-Cell Battery



**H**ot commo and cold batteries won't compute. They do add up, though— to trouble.

Keeping your dry-cell-using gear communicating during cold weather means keeping them supplied with battery power.

Uncle Sam gives you a hand with some gear. He gives them a more cold-resistant battery when temps drop to below freezing.

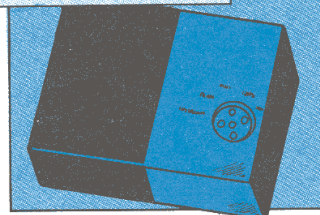
Scope out your equipment's TM and SB 11-6 for specific information on batteries for cold-weather operation, if available.

A new edition of SB 11-6 (Apr 93) supersedes the one dated Dec 87. Whether you have the old or new supply bulletin, both list the primary battery using equipment, battery type numbers and NSNs. Follow your bulletin's advice on using cold-weather batteries.

# Insurance

For example, the BA-5598 lithium battery, NSN 6135-01-034-2239, gives your AN/PRC-77 radio set a big boost in

BA-5598 lithium battery gives AN/PRC-77 a lift.



cold weather. Other batteries will do the same for specific pieces of equipment.

Give even cold-weather batteries a hand. Store 'em as described in your SB 11-6.

Then, warm up only as many spares as you think you'll need. Keep the rest stored.

Lithium batteries won't need warming up unless they've been exposed to temperatures below -20° F.

Protect all dry cells, of course. Keep 'em in your clothing, a vehicle or commo shelter when possible . . . anywhere out of the cold and wind chill.

A wind break is better than out in the open and next to your body is best of all.

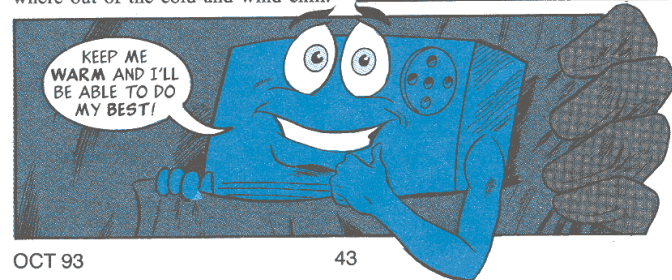
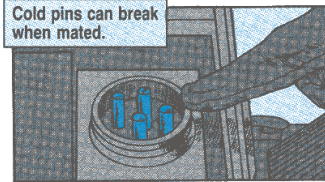
Carry as many extras as you can. Then you can switch when the ones in your gear lose zip. Batteries from your gear go in your clothing to warm up. They should regain enough punch to do the job later.

If your gear won't be on line for awhile, don't install batteries. Keep 'em warm as long as you can—but not above 80°F for extended periods.

If you warm batteries in a heated place, watch for sweating. Wipe moisture off when you see it or it'll turn to ice in the cold.

Finally, if your batteries have to mate with plastic pins to do their job, be careful when installing 'em. Pins get brittle, and can break if handled too roughly.

Cold pins can break when mated.



## PATIENCE IS

## THE ANSWER

BONNIE, I'M TRYING TO CALL BATTALION HEADQUARTERS, BUT ALL I GET IS STATIC!

DID YOU REMEMBER TO WARM UP YOUR RADIO?



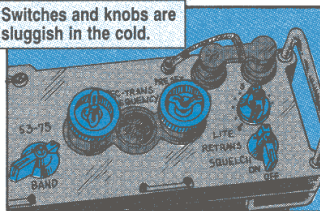
**A**dd patience and a little warmup to your PM tools this cold season. They can save your phones, radios and commo accessories a lot of downtime.

Patience — like waiting 10 to 15 minutes for your radio set to warm to its task before you transmit. Radio sets can use that extra time to shake off the cold and prevent damage.

Gear that gets greased — like teletype-writers — needs the time to ward off sluggishness. Warm gears and keyboards, especially.

Be patient with sluggish control knobs and switches. Go easy with brittle switches or shock isolators. Rough stuff's a killer.

Switches and knobs are sluggish in the cold.



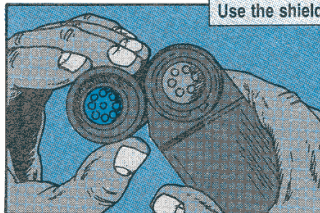
## Accessory PM

Good cold-weather PM extends to your handsets, headsets and micro-phones.

Moisture from condensation is the big enemy. Moving inside, outside and back again makes 'em sweat. You can equalize temps somewhat by keeping accessories inside your clothing, or wrapped in something woolen.

You supply some of the moisture, tho, when you speak into the mouth-piece. Use the deicing shield, if your gear has it. That keeps condensation from getting inside the gear and shorting it out.

Use the shield.



If the shield is meant to go outside, put it there. Some troops put it inside 'cause they think they'll lose it on the outside. But inside it can't do its job of keeping your hot breath out. Condensation forms and can short out your commo.

Installed correctly, it'll stay put. Just line up the dot on the shield with the one on the handset. Then press down evenly around the shield to seat it.

No shield? The cellophane from a cigarette pack or the plastic from a dry-

cell battery will do if it's thin enough to talk through.

You can head off another kind of moisture problem by not spitting. Spitting into the connector, that is. That might make connection easier, but it can also freeze your cable to the receptacle. Use a dab of silicone, NSN 6850-00-880-7616, for easy connections.

Watch metal or plastic handsets and headsets, too. If it gets too cold and you touch the material with your skin, you might stick.

ALL IT TAKES IS A LITTLE PATIENCE AND EASY HANDLING TO GET YOUR COMMO GEAR THROUGH THE WINTER.



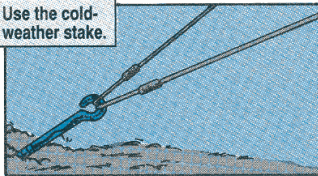
# Special Attention Is a Must

Your mast-type antennas need special attention and good PM in cold weather as much as any piece of gear you use.

For instance, during good weather it's not too hard to sink a guy stake. Cold weather changes all that.

If your mast doesn't have a cold-weather stake (like the RC-292 antenna equipment's GP-101, NSN 4030-00-187-5265) a good sub is the GP-112 for your OE-254 antenna group. It goes by NSN 4030-00-291-9354.

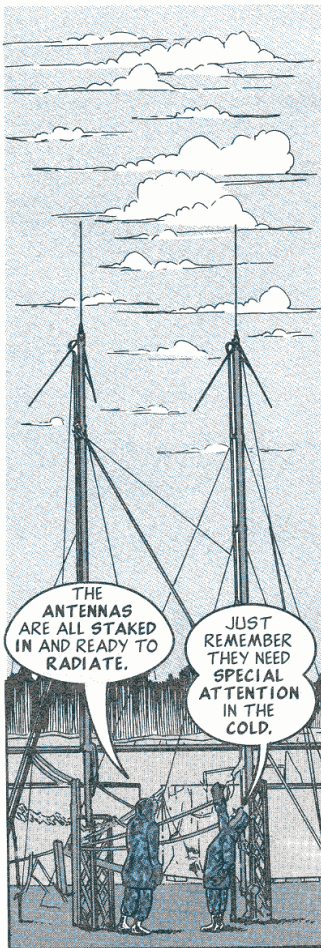
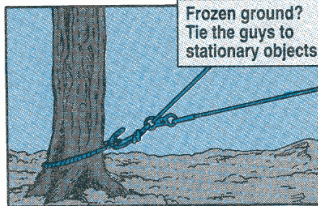
Use the cold-weather stake.



Watch cold-weather stakes, though. Because they're slimmer, they don't hold as well when the ground thaws. Keep an eye on 'em during warming days.

In a pinch, you can tie your guy to a stationary object. A tree or a pole will do. Don't try to get by with fewer guys than your TM calls for. That's looking for trouble.

Frozen ground? Tie the guys to stationary objects.



THE ANTENNAS ARE ALL STAKED IN AND READY TO RADIATE.

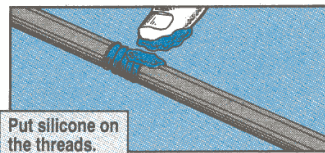
JUST REMEMBER THEY NEED SPECIAL ATTENTION IN THE COLD.

Another stake you work with when installing your mast and its radio equipment is the ground. Be sure you have a good one. See the tips in TC 11-6.

## Grease the Joints

Those mast and whip antenna sections can freeze together for real during chilly weather. Check your pubs for the right lube, of course, but usually a dab of silicone will do.

A 2-oz tube is yours with NSN 6850-00-177-5094. A bigger 8-oz supply is NSN 6850-00-880-7616.



Put silicone on the threads.

Be sure mating surfaces are clean before you lube. Clean all other outer surfaces as well.

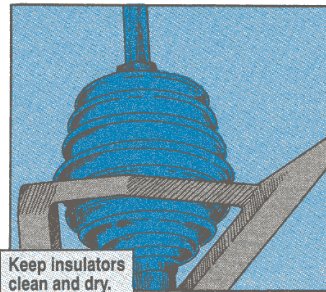
Keep ice off your mast. Besides cutting down the radiating distance of your antenna, it poses a real safety hazard. Think what a chunk of ice on your noggin would do to your day.

## Bowl Dry?

Keep ceramic bowls dry. Water collects in 'em during warm weather. Comes a cold snap, and it turns to ice. That can crack the glass. Course, the freezing temps make the glass more brittle—and breakable anyway. Handle it carefully.

Once you've wiped the bowl clean and dry, reach for your tube of silicone

again. Seal the insulator before you join the 2 halves.



Keep insulators clean and dry.

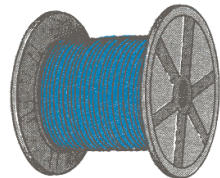
## Cable Cautions

Your RF cables need special handling during cold weather, too. Insulation becomes brittle and can break. That can damage delicate inside wiring.

You keep it from knocking around too much by taping it to the antenna where possible—like with your OE-254 and RC-292.

Normal tape loses some of its staying power in sub-freezing temps. Substitute some cold weather TL-600 tape, NSN 5970-00-240-0620. If it's too cold even for the tape, use clamps to relieve the strain on your cable. Order 'em with NSN 5975-00-563-0229.

Give cords and cables special attention.



# Kinks and Crimps Can Cram Your Style

When temperatures drop, keep comms on line with some cold weather PM.

During cold weather, cables and wires need more care. Watch for kinks and crimps in wire and cable. Rubber insulation cracks and breaks when it freezes. Even worse, the inside wires can break when it's cold.

In extreme cold weather, use these NSNs to order arctic insulated wire:

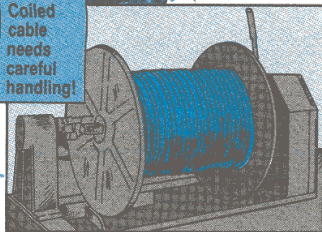
Item	NSN 6145-01-155-
RL-159 reel with 1 mile wire	4256
MX-306 reel with 1/2 mile wire	4257
DR-8 reel with 1/4 mile wire	4258

It's best to keep cable and wire off the ground and out of the way of feet, vehicles and cargo areas. In fact, stringing 'em overhead gives you the added advantage of not letting wires and cables freeze to the ground. That creates a pain when you start to recover 'em.

Leave a little slack when you lay wire or cable. Metal and rubber shrink in the cold. If you pull the wire or cable too tight you invite a break.

Have a little patience when reeling wire and cable. Reeled wire freezes into its coiled shape, of course. Warm it up before unreeling, if possible.

Coiled cable needs careful handling!



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If you can store it inside a shelter, so much the better. A good idea is to take tightly-coiled cable and store it in bigger coils where it's warm before taking it into the cold. That'll reduce the chances of a pinch or break.

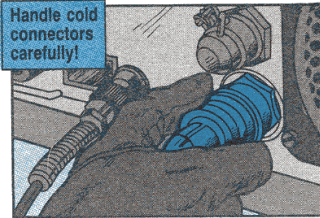
That's good for cold cable, too. Before coiling it, warm it up if possible.

If you have to splice or repair wire, use a tape that'll hold in the cold. TL-600 cold weather electrical tape, NSN 5970-00-240-0620, does the job. The tape comes in a 30-ft roll.

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Connecting or disconnecting cables takes a little more care in cold weather, too. Rough stuff'll break something like receptacles or connectors.

Handle cold connectors carefully!



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# Keep the Volts Coming!

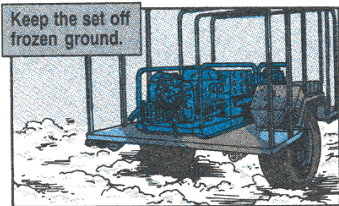


**W**hen the wind chill has blown all the humor out of “Hey, is it cold enough for ya?”, it’s time to get hot on your small engine PM.

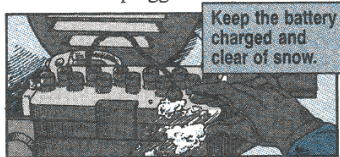
After all, the engine that starts and powers your generator has to sit outside while you warm your tootsies inside.

Here’s a double gloveful of PM hints that will keep the volts coming:

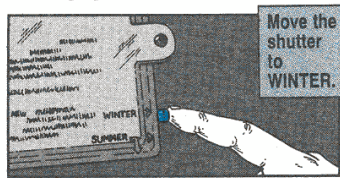
- Keep the set off snow or ice. Use a wooden pallet or a trailer so the set won’t freeze to the ground. You can also use vehicles, tents or buildings to shelter your set.



- Keep ice and snow off the battery, engine and away from the fuel tank and filler cap. Be sure battery cap vent holes are not plugged.



- Move the air filter’s intake shutter to **WINTER** when temps dip below freezing. That lets warm air from the manifold keep the carburetor from freezing up.



- Preheat the rest of the set according to TM directions.

- Store bulk oil and lube inside to make them easier to pour. Lube according to the LO and the temperature range you’re in.

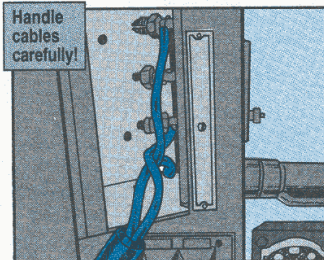
- Keep the fuel tank full to head off condensation that can freeze in the fuel line.

- Use the right fuel icing inhibitor. Gas uses technical methanol; diesel fuel takes fuel system icing inhibitor. The ratio for both is 1 pint per 40 gallons of fuel. Inhibitor comes in 5-gal cans, NSN 6850-00-753-5061 and 55-gal drums, NSN 6850-00-060-5312. Methanol is NSN 6810-00-597-3608 for 1 gallon and NSN 6810-00-275-6010 for 5 gallons.

- Keep batteries fully charged. Water added to a battery will freeze if the battery isn’t charged for at least an hour.

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- Handle cables and wiring as little as possible. Insulation becomes brittle in the cold.



- Warm your set before you put it into operation. Run it — at rated speed — until it hits operating temperature. No idling, though.

- Check your sets frequently for unusual noises or gauge readings.

- Read your TMs for additional cold weather information.

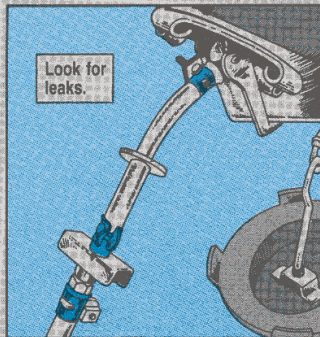
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# Toaster or Flame Thrower?

The M1941 space heater can keep your tent toasty warm on cold nights. But neglect PM and your heater can turn into a fire-breathing monster!

## Fuel Lines

Before lighting your heater, check the fuel lines and connections for leaks. Fix any leaks before lighting up.



When you hook up the overflow line, remember to:

✘ Keep the hose lower than the fuel overflow connection on the float valve assembly.



Slope overflow line down to container outside.



- ✘ Keep kinks out of the line.
- ✘ Keep the line out of the way of big feet.
- ✘ Keep the line running downward, outside and away from the tent, like it tells you on Page 2-7 of TM 10-4500-200-13.
- ✘ Use a container to catch the overflow fuel to guard against an unwanted blaze and to reuse it.

## Heater Setup

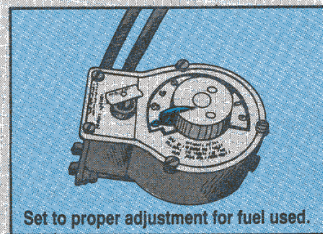
The fuel control valve will work the way it's supposed to when the heater and valve are level, so make sure they're level.

If you have a wooden floor in your tent, set the stove in a sandbox or on a non-combustible surface.

If you're setting the heater on top of snow, use a sandbox or non-combustible panel, too. Otherwise, the hot heater will melt its way into the snow.

## Firing It Up

When starting the heater on oil or diesel, turn the ON-OFF valve to ON. Set the adjustment knob to 9.



Set to proper adjustment for fuel used.

When the bottom of the burner is wet with fuel, turn the adjustment knob to 0.

Drop a small wad of lighted paper or a lighted oily rag into the burner.

If you're burning gasoline, begin by dropping a lighted match or burning paper into the burner. Then turn the the ON-OFF valve to ON with the adjustment knob set to 0.

**Keep your face and hands away from the opening!**

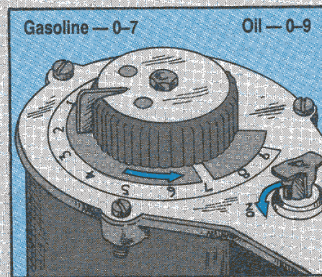
Replace the top lid when the bottom of the heater is full of fire.

## Adjusting the Flame

Wait five minutes when gasoline is used—fifteen minutes for oil—to let

the heater warm up. Then set the adjustment knob to regulate the size of flame you want.

When using gasoline, set the adjustment knob between 0 and 7. Setting it above 7 wastes fuel and makes heavy smoke and is a safety hazard. For oil, set it between 0 and 9.



But never leave the knob at 9, even in the coldest weather. At the maximum setting the heater or the flue can get hot enough to set your tent on fire.

If you get heavy, black smoke from your heater, turn the adjustment knob to 0. Let the excess fuel burn off, then reset the control knob.

## Keep Fuel Strainer Clean

Keep the fuel strainer clean to let your heater get a good flow of fuel. But be sure not to damage or bend the strainer when you clean it.

A damaged strainer can let unfiltered fuel into the system that can clog the float valve assembly.

If the strainer is damaged, replace it with NSN 5411-01-231-1754.

# Stay Warm to Perform

The Extended Cold-Weather Clothing System (ECWCS) can't perform the way it should if you don't perform PM.



Undershirt, cold weather; Trousers, cold weather; Drawers, cold weather.



Overalls, cold weather.



Shirt, cold weather.



Parka, cold weather; Trousers, cold weather; Hood, balaclava.

IT'S TIME TO PUT OUR PLANS INTO ACTION, MOISTURE!

LET'S GO DIRT!

■ Brush your clothing often while wearing it. Dirt clogs airspace between the fibers and reduces insulation. Dirt will cut the fibers. It also holds in perspiration.

■ Keep clothing dry. Wet clothing is cold clothing. Dampness also increases body heat loss.

If you get any piece of your ECWCS wet, get out of it as soon as you can. Hang wet clothing to dry on a non-metallic hanger but not so close to a stove as to burn it.

■ Brush and air-dry the clothing before storage to prevent mildew.

■ When packing clothing, wrap it in paper and store it in a heavy cardboard box. This makes sure it doesn't touch sharp objects that will tear it.

## Cleaning

The parka and trousers are water repellent. Before you wash and dry them, eyeball them for rips and tears. If you see any, repair them.

Wash the garments with a mild powdered detergent, not a liquid detergent. Liquid detergents wash away water repellency. Rinse clothing real good in clean, warm water to get rid of all the detergent.

Restore the water repellency by steaming the parka and trousers. Set your iron on STEAM. Hold it about 1/2 inch above the garment. Steam all over, but DO NOT PRESS!

Underwear needs extra care when you wash and dry it, too.

Wash the underwear in COLD water using cold water detergent. Rinse in cold water, too. Never use bleach or starch.

Drip drying is the best method. To drip dry, wring out all the water you can, then hang on a rust-proof hanger. If you must use a dryer, tumble dry at the lowest setting. Keep a close eye on your underwear and remove them as soon as they're dry.

Wash the other items the same as you do the underwear.

## Repair

You'll find repair information in a handy pamphlet on the ECWCS prepared by the Natick RD&E Center. If your unit needs copies, order Use and Care of the ECWCS using item number AD 187998 from:

Defense Technical Information Center  
National Technical Information Service  
US Department of Commerce  
Springfield, VA 22161

And for more repair, cleaning and laundering info, eyeball Chap 20 of TM 10-8400-201-23.

WHAT'S GOIN' ON?!

I THINK OUR PLANS HAVE TURNED TO MUD!

# Don't Get

**C**old feet can turn a good day into a nightmare! The black cold-weather boots and the white extreme cold-weather boots will keep your feet warm and comfortable with these PM tips:

THOSE ARE SOME BIG BOOTS!

THEY HAVE A BIG JOB TO DO IN COLD WEATHER.

Watch your step. If you puncture a boot—either on the outside or inside—it can put them out of action . . . for good. Water gets in the layer of insulation that's sealed inside. Wet insulation lets the cold through, and your feet freeze.

Patch holes as soon as you find them using the cold-weather maintenance kit, NSN 8465-00-753-6335. Put the adhesive to both the boot and the patch. Don't depend on the patches to hold up long in the field, though. They're good only for emergencies. When you come back in from the field, turn the boots in to be tested.

# Cold Feet

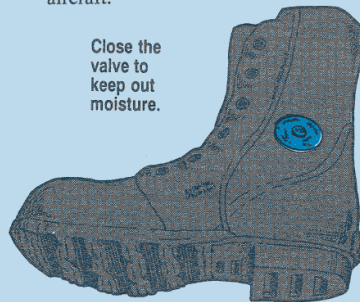
If open, the air pressure relief valve will let moisture in, too. Keep the valve closed unless you're going up in an aircraft.

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. Excessive heat will damage boots, so never dry them near a fire or other heat source.

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.

Close the valve to keep out moisture.



## Inserts for Mittens

**Y**our cold weather trigger finger mitten shells, medium NSN 8415-00-926-1526, and large NSN 8415-00-926-1527, won't be enough to protect your hands when the temperature drops to below freezing. You'll need to wear cold weather trigger finger M-1965 mitten inserts inside them. The mitten inserts come in two sizes:

- Medium NSN 8415-00-160-0769
- Large NSN 8415-00-160-1376

Make sure the inserts are the right size. Oversize mittens mean cold air pockets.



# Helpful Hints for Hoods



If your head's warm, your whole body feels warmer.

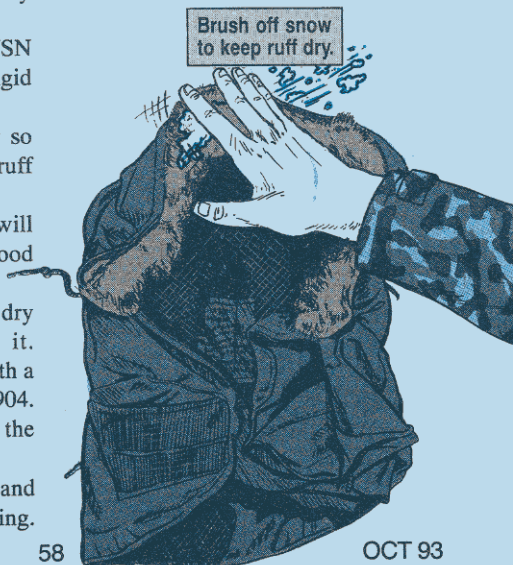
The extreme cold-weather hood, NSN 8415-00-782-3004, will keep the frigid winter air away from your head.

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.

Never machine wash or machine dry your hood. That will damage it. Handwash it in lukewarm water with a mild detergent, NSN 7930-00-985-6904. Rinse it in clean water, shake out the excess and hang to dry.

Brush the ruff to make it soft and fluffy if it gets matted during washing.



# Liner Lessons

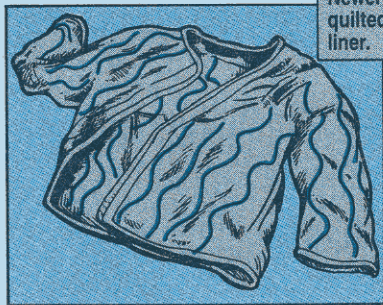
**T**he way you put the liner in your extreme cold-weather parka makes a difference. You'll stay warmer with the liner in right.



White fleece toward the parka.

For the older style liners, the white fleece side goes toward the parka shell. It creates a space for warm air between the cold outer shell and the inner layer next to your body. It's that insulation that keeps you warm.

Newer quilted liners have a layer of slick protective cloth on each side of the insulation, so the insulating dead air is trapped between them.



Newer quilted liner.

Dirt and sweat rob your liner of its insulating ability, too. Keep it as clean as possible for best results.



HOW COME I'M THE ONLY ONE WHO'S FREEZING?

MAYBE YOU'RE THE ONLY ONE WITH YOUR LINER IN THE WRONG WAY.

# Plastic Water Can



H-H-HELP  
M-M-ME!!

Here are some PM tips to protect your plastic water cans in cold temperatures.

- Water in the cans will freeze. To prevent damage, fill cans to within no more than 3 inches of the top.
- Never apply heat to a frozen can. The plastic will melt.
- Keep the cans off the ground. Set 'em on cribbing.
- Place the cans in insulating cases, NSN 7240-00-125-9061.

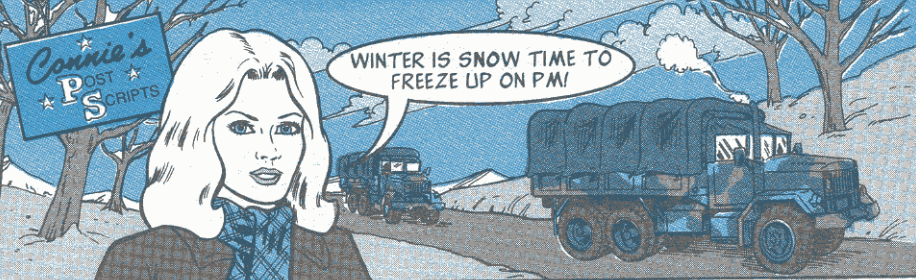
## Strapping and Sealing Kit

YOU CAN LOOK UNTIL YOUR EYEBALLS ACHE, BUT YOU WON'T FIND A PUB WITH THE BREAKDOWN FOR THE STEEL STRAPPING AND SEALING KIT, NSN 3540-00-565-6241.

BUT, YOU CAN LOOK HERE AND FIND ALL THE PARTS FOR THE KIT...



Item	NSN
Sealer	3540-00-234-6741
Stretcher	3540-00-278-1250
Strapping, 1/2-in wide	8135-00-283-0666
Seal, 1/2-in wide	8135-00-239-5308



### Fire Extinguisher Bracket

NSN 4120-00-775-0127 gets the bracket for the 5-lb fire extinguisher used on M939-series 5-ton trucks. Make a note until the -20P TM is updated.

### MIRAC Moves

The address and phone number for the MIRAC hotline have changed. Now when you find an item on the AMDF that you think is overpriced, write:

USAMC

Logistics Support Activity

ATTN: AMXLS-LCF

Redstone Arsenal, AL 35898-7466

Or call

DSN 645-0778

Commercial (205) 955-0778

### New CUCV Plugs OK

Redesigned Wellman glow plugs, NSN 2920-01-151-3627, are now in the supply system for CUCVs. The new plugs have silver electrical connectors, not copper-colored like the old, faulty ones. Additionally, the plug container is different. Part number 6A843G070 is stamped on one end, and the bar code background color is yellow, not white.

### Replacement Armor NSN

On the M22 binoculars, you can now order the rubber armor piece that surrounds the objective lens. Use NSN 5365-01-348-7037.

### M939 Grease Gun NSN

Use NSN 4930-00-253-2478 to get the 14-oz grease gun that's shown in the M939-series truck's Bill list. The NSN shown in the operator's TM is wrong.

### M870 King Pin NSN

To get the M870 semitrailer's king pin, item 1, Fig 10 of TM 9-2330-360-14&P, order only on a DD Form 1348-6. Use CAGE 26697, PN MPO-0897 and RIC S91. Make sure to use advice code 2B in card columns 65 and 66 or you'll end up with the wrong part. Note in the Remarks column that "NSN 5315-00-530-4819 is not on the AMDF."

### M860A1 Outrigger Nut NSN

Get a replacement nut for the front and rear outrigger assembly on the M860A1 flatbed semitrailer with NSN 5310-00-208-1529. The info shown for Item 5, Fig 35 in TM 9-2330-357-14&P is no good.

### M915-Series Tire Pressure

The tire pressure chart on Page 2-44.10 of TM 9-2320-273-20 applies to both radial and bias ply tires on the M915-series trucks. Make a note until the TM is updated.

### M939 Pliers NSN

Use NSN 5120-00-223-7397 to get the 8-in pliers shown in the M939-series truck's Bill list. The NSN shown in the operator's TM is wrong.

Distribution: To be distributed in accordance with DA Form 12-34-C-R, for TB-43-series.

**Would You Stake Your Life <sup>right now</sup> on the Condition of Your Equipment?**

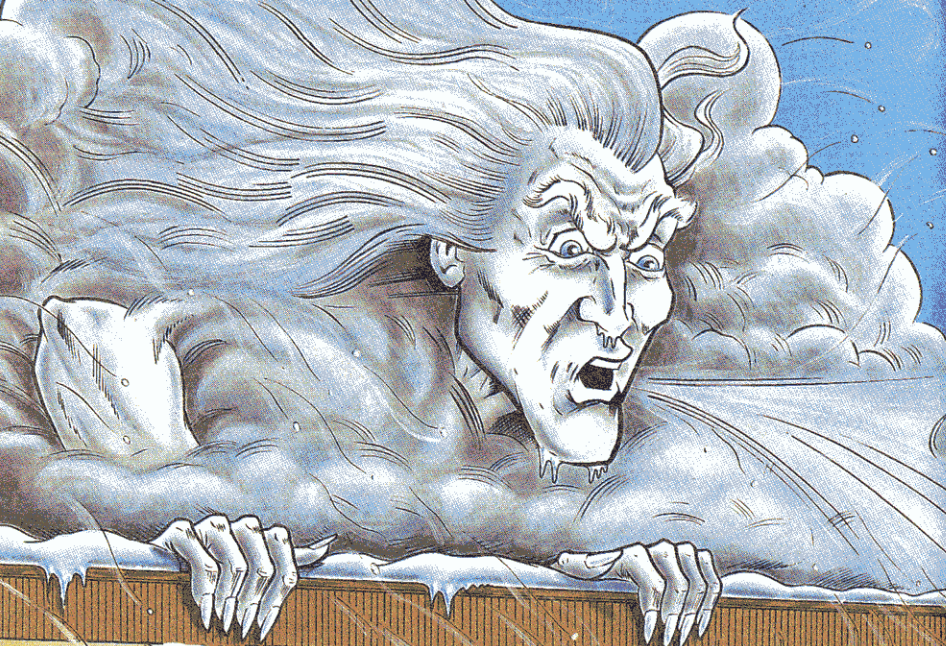
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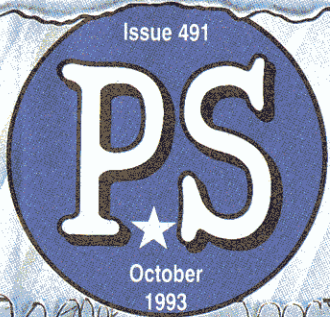




***Don't Let Old Man Winter  
Force You to Learn PM  
the Hard Way***



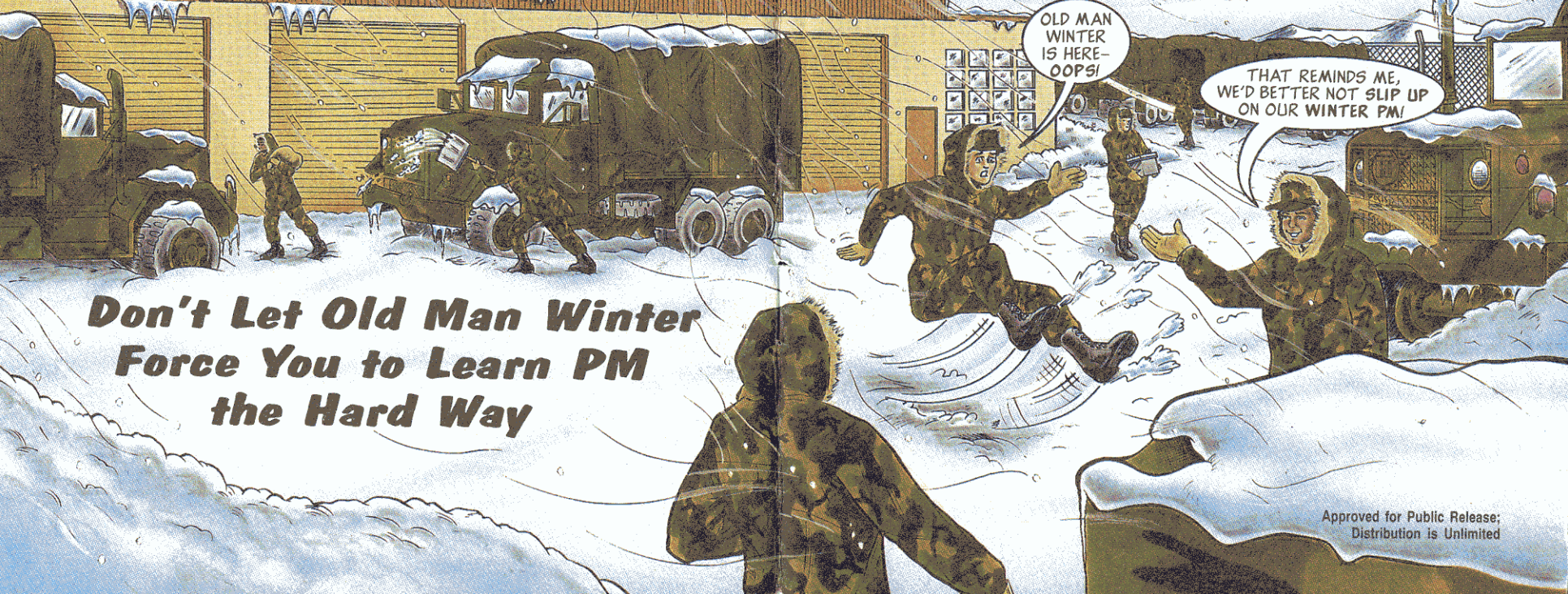
Issue 491



# THE PREVENTIVE MAINTENANCE MONTHLY

TB 43-PS-491

Read this copy  
and pass it on!



OLD MAN  
WINTER  
IS HERE—  
OOPS!

THAT REMINDS ME,  
WE'D BETTER NOT SLIP UP  
ON OUR WINTER PM!

**Don't Let Old Man Winter  
Force You to Learn PM  
the Hard Way**

Approved for Public Release;  
Distribution is Unlimited