

# WINTERIZATION TO IMPROVE UPTIME

**{ RECOMMENDED PRACTICES  
TO PREPARE VEHICLES FOR  
COLDER MONTHS. }**

By David Brierley, Managing Editor

## [ MAINTENANCE & SERVICE ]

**P**reventive maintenance (PM) is key to vehicle uptime year-round. But, during winter months in northern climates, when subzero temperatures, snow, ice and road salt can wreak havoc on vehicle systems, PMs alone may not be enough to keep vehicles on the road. In these conditions, an improperly specified or under-serviced vehicle could leave drivers stranded and rack up exorbitant towing and repair fees.

To avoid these consequences and maximize uptime, fleets should be sure to keep up with PM schedules, implement a winterization plan to prepare components for cold weather and specify vehicles appropriately for operating conditions.

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» Winter months in northern climates can be brutal, with cold temperatures and inclement weather wreaking havoc on vehicle systems.

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## Air systems

Arguably one of the most important systems on a heavy duty vehicle is the compressed air system. On modern vehicles, multiple components may rely on the air system: braking, suspension, automated manual transmissions (AMT) and even emissions systems. Because these critical components require air, it is imperative that the air system be kept in proper working condition at all times.

### Air systems: Problem

Excessive moisture in the air system can cause issues at any time of year, but it is especially detrimental in sub-freezing temperatures.

“Any moisture in the system when we get into sub-freezing [temperatures] can cause brake line freeze-up, valve freeze-up,” says Rich Nagel, director of marketing and customer solutions at Bendix

Fleets should be sure to implement a winterization plan to prepare components for cold weather.

» The air dryer is located between the air compressor and the rest of the air system. It uses replaceable cartridges containing desiccant material, which attracts and traps moisture before it can reach the rest of the system.

Photo courtesy of Meritor

» To prevent fuel gelling, fleets should use proper additives with every fill-up during months when the weather has a potential to turn cold.

Photo courtesy of Penray

Charging. “Increasingly, air is used in pneumatic automation, so you could have issues with [automated manual] transmissions, emission controls, all these things that run off of compressed air.”

If an air brake system freezes up, it can render the vehicle inoperable and leave the driver stranded in potentially unsafe conditions. The only OEM-approved option to rectify the situation is to tow the vehicle to a location where it can be placed in a heated maintenance bay to thaw, which can be very expensive and cause increased downtime.

There are brake system deicer additives available, but manufacturers typically do not recommend their use because they may damage brake valves and other system components. However, when faced with extended downtime and towing costs, fleets may choose to use them as a quick fix.

Tim Hale, air system product manager at Meritor, confirms that deicing compounds used in extreme circumstances should be used sparingly, and that the amount and application area of these

substances should be recorded due to the potential to cause leaks or corrosion of internal components.

“If you’re going to [use a brake system deicing additive], as part of your preventative maintenance you may want to look at replacing some of the products where you had issues,” Nagel adds. “Those deicing compounds can damage seals and they can do a lot of damage to the brake valve.”



» Some engines can lose gallons of glycol in a year, so freeze levels must be checked during a vehicle’s scheduled PM, especially before winter.

Photo courtesy of TravelCenters of America







### Air systems: Solution

While most think of summer as the humid time of year in northern climates and winter as bone dry, there is actually a relatively high amount of moisture in the air when it's cold.

"Even in winter, there's still humidity in the air that gets pulled in through the air compressor and then goes into the service tanks," Nagel says. "The [air] dryer's job is to remove that moisture."

The air dryer is located between the air compressor and the rest of the air system. It uses replaceable cartridges containing desiccant material, which attracts and traps moisture before it can reach the rest of the system. Periodically, the system backflushes air through the air dryer to clear moisture from the desiccant and vent it to the outside.

Nagel explains that by design, mechanical air compressors pass minute amounts of oil. So, in addition to preventing moisture from passing into the air system, the air dryer has to filter oil aerosols as well. This eventually leads to decreased performance.

"The desiccant itself doesn't really wear out, but over time it gets contaminated with oil aerosols, and it becomes less effective," Nagel says. "When the dryer desiccant gets contaminated, [it doesn't] remove all the moisture in the system. That [moisture] goes into the service tanks and eventually into the brake system, sits around at low points in the brake system and freezes in winter."

The easiest way to prevent this from happening is by including air dryer inspection and service as part of a fleet's regular PM program.

"An important preventative measure is ensuring proper care of the air system with year-round maintenance of the air cartridge," Hale says. "Moisture and contaminants that make it into the

air system past an improper or defective cartridge during warmer months will not be removed by replacing the air cartridge in October. It is important to inspect and maintain the air dryer and cartridge through[out] the entire year."

Most OEs and air system manufacturers publish recommended replacement intervals for desiccant cartridges. Bendix, for example, recommends replacement every three years for standard air usage applications such as line haul and city delivery; every two years for medium air usage applications such as double trailer trains, light transit and light off-highway; and every year for high air usage applications such as multiple trailer trains, city transit and heavy off-highway.

Nagel adds that location can also play a factor in replacement intervals, and that operating in colder climates can put additional stress on air systems. The bottom line is that fleets should visually inspect the air tanks to see if the air dryer is operating correctly. If excessive moisture is present, more frequent cartridge replacement may be necessary.

Hale adds that if moisture has collected in the

» **Checking battery cables for signs of loose or corroded connections is important, but the state of the battery itself should also be tested to get an idea of the condition.**

Photo courtesy of TravelCenters of America

air tanks, it must be drained. Once the water has drained, the plugs should be left out long enough for the tanks to dry out completely.

Fleets should also be cautious about the replacement cartridges used. While aftermarket parts may offer lower pricing, the desiccant inside may not be the same quality as an OE part, and therefore require more frequent replacement or even cause issues that could have otherwise been avoided.

Other maintenance items on air dryer systems include replacing the purge valve, which road salt and other debris can clog, especially after a hard or particularly long winter. Another part that is relatively inexpensive and easy to change is the air dryer heater. This part is imperative to keep the air system working in freezing temperatures, and there is no indicator as to whether or not the heater is working, so replacing it periodically is the only way to ensure proper function.

An important preventative measure is year-round maintenance of the air cartridge.

### Electrical systems

Like the air system, a vehicle's electrical system can be dramatically impacted by winter weather. Battery life can suffer in the cold, leading to alternator trouble or even starting issues. Plus, salts and chemicals used to melt ice on roadways can cause corrosion in wiring harnesses, leading to poor electrical connections. To prevent this from happening, fleets should take preventative measures before winter weather sets in.

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# Preventive maintenance winter checklist



## PM ITEMS

"Everything in fleet maintenance starts and ends with the proper equipment specifications for your operational environment and use," says Gerry Mead, executive director of innovation at Phillips Industries. "If you fail to spec the equipment properly, it will fail to meet your needs. The next important item is your PM program. Key items when it comes to keeping costs low while balancing quality can be time-consuming, but well worth it if you are results-oriented or KPI-driven."

• **Battery:** Regularly perform a battery load test to ensure

the cold cranking amps (CCA) meet specifications. Clean the terminals and ensure a corrosion-free and tight connection.

- **Coolant:** Ensure the freeze point for the vehicle's antifreeze is well below temperatures that will be encountered.
- **Windshield:** Fill windshield washer fluid reservoirs with fluid that won't freeze in cold temperatures. Verify that windshield wipers are clearing the driver's view correctly. Winter-specific blades tend to do a better job at swatting away moisture than standard blades.

• **7-way trailer connector:** Inspect and clean the back-of-cab 7-way connector, and don't overlook the cap as it is designed to keep the cable secure in the socket. Inspect the cap spring to ensure it snaps back in place as well as the notch that interlocks with the 7-way connector end. Apply dielectric grease to prevent water intrusion. Check the cable itself for corrosion and worn pins, as well as a worn head. Also look at the plug and cap on the front of the coupled unit for the same issues and clean and re-grease periodically for longevity.

regeneration at each PM will help reduce failure, but reduction in idle is always the best. Keep in mind that during cold weather a vehicle will idle more often to keep the operator safe and comfortable. Drivers should be instructed on how to respond to DPF dash warning lights so a DPF failure does not occur.

• **Wash:** A wash program is often overlooked. Fleets should implement a consistent wash program that includes an environmentally-safe chemical to stop the corrosion of road chemicals from eating away at vehicle systems year-round.

• **Belts:** Inspect the serpentine belt for cracks or excessive wear.

• **Wiring:** Inspect wiring for cracks, rubs and cuts or excessive connectors from an old repair. Always use sealable connectors and inspect the wire up past the break for additional problems. Wiring can wick moisture and additional corrosion might be present further up from the initial problem area.

• **Filters:** Service fuel and coolant filters, if equipped, as well as the air dryer cartridge. Specific OEM recommended intervals are a good minimum, but may need to be adjusted based on specific fleet operations to help set a better interval for replacement.

• **Fifth wheel:** Lubricate and clean the fifth wheel. Besides lubricating the pivot points and top plate with grease, it is a best practice to spray the jaws with a diesel fuel lube oil mixture after ensuring they are debris- and grease-free.

• **Glad hands:** Check glad hand seals. Mead recommends replacing these if in doubt, as they are an inexpensive item that could lead to a very expensive issue in case of failure. Also check the glad hands themselves, making sure they still lock tightly and are free from cracks and debris.

• **Spring brakes:** Check the air spring brake chamber dust cap. Keeping caps in place will prevent power spring contamination, which could lead to failure.

• **Tires:** Tires are also vital and require not only proper tread depth, but proper air pressure. Air pressure will not only affect the footprint of the tire, but also the ride for the operator.

• **DPF filter:** With the advent of engine regulations, fleets must ensure the aftertreatment system is ready. Look at idle time versus change interval and ensure DPF filters are changed when needed. A forced

## ON-ROAD AUDIT ITEMS

While pre- and post-trip inspections are always critical, drivers must perform additional audits when it comes to operating in the cold, to ensure they do not experience an unplanned maintenance event or accident.

✓ Ensure that lights are not covered with ice, snow or road film.

✓ Store cables in their holder when not in use.

✓ Check the snow load on top of the trailer as well as snow on the hood of the tractor itself.

✓ With today's ADAS-equipped vehicles, it is important to ensure the radar unit is also free of debris for proper system operation.

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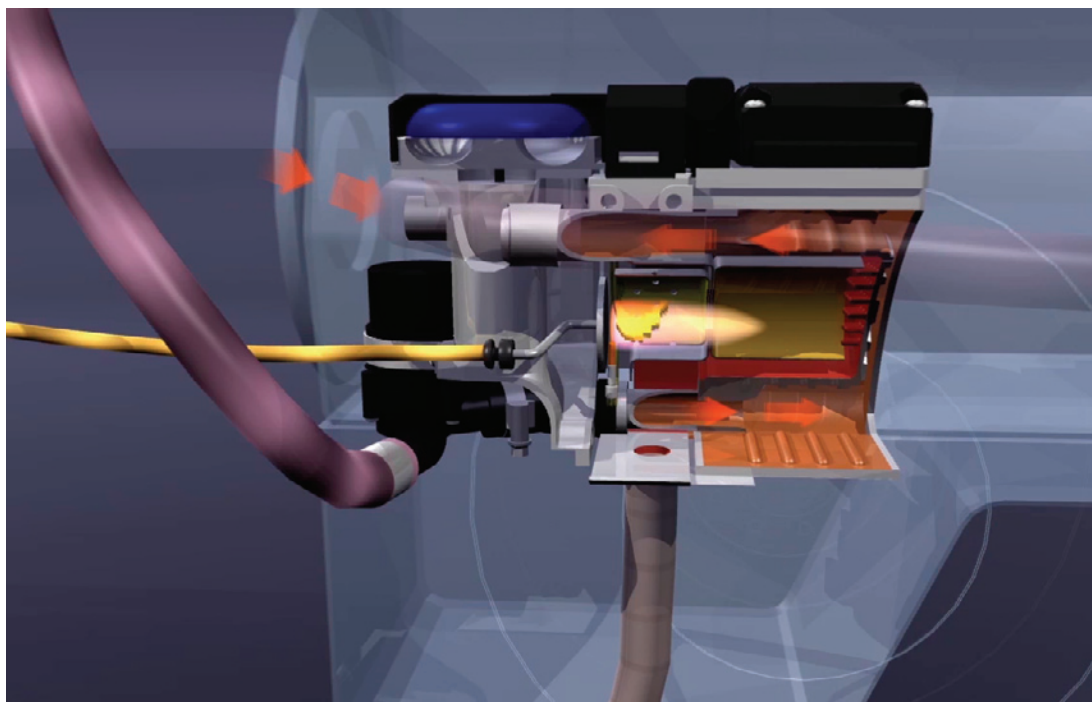
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» “Coolant heaters are integrated with the vehicle’s coolant system to provide heat to the engine while the engine is off,” says Webasto’s Mark Denny.

Image courtesy of Webasto





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### Electrical systems: Problem

Increased use of items such as APUs and bunk heaters to reduce engine idle time helps boost efficiency and reduce fuel consumption and wear and tear on the engine. However, when the engine is not running, the alternator is not providing power to the system, nor is it charging the battery.

“In the winter particularly, sleeper cabs supporting human habitability must often operate electronic equipment without the support of their primary diesel engines and must use APUs, or dedicated bunk heaters,” says Brett Johnson, president and CEO of Optronics International.

The result is that operators often have to make decisions as to what equipment can be switched on, and for how long, in order to make sure that there will be enough power to start the vehicle’s engine.



» Using an air heater instead of idling the vehicle’s engine can save fleets on fuel costs and reduce engine wear and tear.

Image courtesy of Webasto

Vehicles are more difficult to start in the cold, confirms Jeff Barron, engineering and technical services at Interstate Batteries. This is partly because oils, anti-freeze, power steering fluids and transmission fluids all have a higher viscosity than they would in higher temperatures, making the engine harder for the starter to turn. Because of this, the amount of power required to start the vehicle is significantly higher.

And, this comes at a time when the battery is not charging at its normal capacity.

“Batteries are slow to accept a charge when they are cold,” Barron says. “The alternator will output higher voltage to overcome the cold temperatures and will slowly come down to normal after the battery starts to warm up.”

Consistently having to overcome the battery’s low state of charge while also

managing other loads can cause alternator damage, Johnson adds.

Additional electronic issues can come from corroded wiring connections due to moisture and road salt accumulating on exposed or improperly maintained wiring harnesses. This can lead to failures in important electrical systems.

Repairing corroded connections or harnesses will typically consist of replacing at least some sections, which can be costly and time-consuming for fleets looking to maximize uptime, so proper upkeep to avoid these situations is beneficial.

### Electrical systems: Solution

Along with regular PMs, fleets should make sure batteries are in good condition to handle winter weather by doing a few extra checks prior to the arrival of the cold. Checking battery cables for signs of loose or corroded connections is important, but the state of the battery itself should also be tested to get an idea of the condition.

“Check the ... state of charge using a conductance tester or a voltmeter to make sure that the batteries are fully charged,” Barron says. “If possible, check the specific gravities. This will give you an indication as to the true state of charge of the battery and if it will be able to perform during the cold temperatures.”

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The specific gravity of a battery refers to the state of the electrolyte, which is a solution of 65 percent water and 35 percent sulfuric acid. This solution is affected linearly by state of charge or discharge, as well as temperature. The specific gravity requires a proper ratio in order for the chemical reaction to take place, so keeping the electrolyte in balance is imperative to battery health during temperature fluctuation.

Another way to support battery life is to simply use less power. An easy way to do this is to switch all incandescent lights to LEDs. Today's LED lamps use only 10 to 30 percent of the amps needed to illuminate incandescent lamps, depending on the application, Johnson says. Additionally, LEDs require less maintenance since they have a much longer life cycle than incandescent bulbs.

Maintaining batteries is a large step in keeping electrical systems in working order, but electrical connections, cables, wires and harnesses should not be neglected. As vehicles drive through road salts and other chemicals used to keep roads free from ice, these substances spray up and coat any exposed components, leading to accelerated corrosion of any connections that have not been properly prepared.

"Lighting and harness maintenance will maximize system utility and minimize a fleet's exposure to failure," Johnson says.

Connection points are the weakest locations in an electrical system, and each one is a potential avenue for moisture to enter the system. A good way to protect these weak spots is to apply heat-shrink moisture barriers to all electrical connections upon taking delivery of the vehicle.

Wiring and harness connectors are commonly located in areas exposed to high levels of moisture, Johnson adds. If a fleet finds connectors in places like just above or behind tires, it is a good idea to add supplemental protection like plastic looms, moldings or tubing.

Technicians should pay close attention to cables and wiring that have been bent during installation, since this can cause fatigue in the protective insulating layers. Cables and wiring that make contact with sharp metal edges, such

as when wires and cables pass through walls or into body cavities, should be protected from fraying and wearing through over time.

Finally, electrical connectors should all be inspected regularly and the grease replenished when required. Technicians should also apply dielectric grease to grounding ring terminals that are improperly connected to a frame member to prevent a reaction between two different metals.

## Fuels and fluids

A major concern for all fleets operating in cold climates is how fluids react to changes in temperature. For diesel-powered engines, fuel gelling, which clogs fuel lines and filters and can completely disable a vehicle, is a major concern. Other fluids such as engine oil, transmission fluid and power steering fluid become more viscous in cold weather, making the engine

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more difficult to start when cold. Winter weather can also cause issues with coolant, creating crystals which negatively impact the cooling system, and freeze diesel exhaust fluid (DEF), which can cause the engine to de-rate or cause a fault code. Fortunately, there are ways for fleets to avoid these issues and keep fluids flowing properly through vehicle systems.

#### Fuels and fluids: Problem

Fuel gelling occurs when the paraffin in diesel fuel solidifies due to a drop in temperature. When this happens, the solids can clog fuel lines and filters, preventing fuel from being delivered to the engine. With the vehicle effectively disabled, the only way to get back on the road is to tow to a heated maintenance bay to thaw, or add potentially harmful de-gelling compounds to the fuel system.

Oils in vehicle systems don't run a risk of gelling like diesel fuel, but they do thicken and become more viscous as temperatures drop. As mentioned earlier, this can cause the engine to be more difficult to start, drawing much more power from the battery than would otherwise be required. But, it can also make lubricating the engine more difficult, creating a shortage of oil in certain portions until the engine has sufficiently warmed up.

"In cold weather, the engine oil will thicken up limiting its ability to move through the engine quick enough to lubricate the proper components," says Mark Denny, president and CEO of Webasto Thermo and Comfort North America. "This will increase pressure on seals and bearings, starving the engine of vital lubrication."

Coolant, on the other hand, can actually form crystals, causing issues throughout the cooling system. According to Homer Hogg, director of technical service at TravelCenters of America (TA), some engines can lose gallons of glycol in a year, so it is not unusual to find trucks with too much water and not enough glycol. This is one reason why freeze levels must be checked during a vehicle's scheduled PM, and especially before winter.

"Most coolant systems use a 50/50 mixture of antifreeze and water to cool the engine," Denny says. "In extreme temperatures, coolant can produce ice crystals which cause havoc on engine seals, leading to system leaks and debris in the cooling system."

#### Fuels and fluids: Solution

When it comes to fuel gelling, the best solution is prevention. Fleets should use proper additives with every fill-up during months when the weather has a potential to turn cold. Gerry Mead, executive director of innovation at Phillips Industries, recommends northern fleets use fuel additives beginning in October and ending in May.

"Use of appropriate additives with each fuel load throughout the winter can help prevent most fuel-related problems in diesel-powered vehicles," says Greg Mixon, director of heavy duty sales at Penray.

He adds that cold weather additives such as those made by Penray are formulated to prevent



» Fleets should use a tread depth gauge to check each tire, and replace tires that are on the borderline or beyond. The U.S. DOT specifies minimum legal tread depths of 4/32" for steer tires and 2/32" for all others.

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the problem of fuel gelling, and they can also clean the fuel system, prevent wax and ice crystal formation, reduce the cold filter plug point by as much as 30 degrees F and enhance cetane and lubricity.

When it comes to oils, coolant and DEF, the only real option to resolve extreme cold weather problems is to pre-heat the engine. This can be done using auxiliary products such as a coolant heater.

"Coolant heaters are integrated with the vehicle's coolant system to provide heat to the engine while the engine is off," Denny says. "In certain applications, a Webasto heater can be used to warm auxiliary hydraulic tanks, fuel tanks or temperature-sensitive cargo fluid."

This all leads to reduced idling, reduced fuel consumption, reduced engine wear and maintenance and reduced exhaust system wear. Plus, a pre-heated engine is easier to start, draws less power from the battery and provides a comfortable cab temperature to the driver more quickly.



## Additional considerations

In addition to items such as coolant heaters, there are other considerations when specifying a vehicle that can improve safety and driver comfort. One such example is an air heater, which warms the air inside the cab without idling the vehicle's engine.

"Air heaters can be installed to warm the truck's bunk or cab to provide heat to those open areas without running the main power unit," says Webasto's Denny. "By using available duct work, the heaters are capable of directing heat to specific areas or cargo spaces, much like your typical in-home furnace system."

Using an air heater instead of idling the vehicle's engine can save fleets on fuel costs and reduce engine wear and tear.

An additional item to consider is the vehicle's tires. Tires should be visually inspected for tread depth and wear to ensure that they are ready for winter's slick roads. TA's Hogg suggests using a tread depth gauge to check each tire, and replacing tires that are on the borderline or beyond. The U.S. DOT specifies minimum legal tread depths of 4/32" for steer tires and 2/32" for all others, so it would be advisable to replace tires before reaching these levels of wear.

Aside from tread depth, tire pressure is also very important to keep an eye on. According to Meritor's Hale, "the variance in air temperatures with the changing seasons can lower tire pressure to damaging and unsafe levels."

Fleets should regularly check tire pressure manually, or specify or retrofit an automatic tire monitoring and inflation system. When using a tire monitoring and inflation system, it is important to monitor the functions and settings for proper tire pressure.

In some applications, such as snowy mountain passes, proper tire tread depth may not be enough to keep the vehicle on the road. In these cases, it is necessary to use snow chains, which wrap around the drive tires to provide additional traction. In some places, snow chains are legally required during inclement weather, making it imperative to have them ready and serviceable.

## Conclusion

Overcoming Mother Nature has been an ongoing human battle for ages. Technology has made extreme weather conditions more and more survivable, but there are still struggles, and nature can still be deadly.

Jake Schell, associate product manager at Mitchell 1 suggests providing an emergency kit in case the vehicle becomes stranded because of

severe weather or breakdown. Hopefully, with a properly equipped and maintained vehicle, this will not be necessary, but it is always better to be prepared.

Implementing proper and regular preventative maintenance, establishing a winterization regimen and specifying vehicles with appropriate equipment can help keep drivers safe and vehicles on the road. ■



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