TIGHT MAINTENANCE PROGRAM KEEPS EQUIPMENT GOING IN WINTER

Courtesy of John Deere, Moline, Illinois

In extremely cold temperatures and heavy snows, it is very important to help make your equipment function properly. The following recommendations should be followed to operate equipment through the cold months. Remember to perform the regular engine preventive maintenance procedures as outlined in the operator's manual. A little extra time doing this can save valuable work time when you count on your machine to perform.

Since almost all industrial machines are powered by diesel engines, the following procedures apply:

Fuel system

— Use quality fuel that is not contaminated with water. Water in the fuel system is the greatest cause of injection system failure.

— No. 1-D fuel is recommended for use in temperatures below 40° F (5° C).

— Fill fuel tank at the end of each day to prevent condensation inside the tank.

— Do not use fuel additives or deicer containing methanol or methyl alcohol—it will not disperse in diesel fuel and can cause damage to fuel system.

— Fuel filters remove most contamination, but will not stop water. Water becomes emulsified at the transfer pump and will flow through the filter. If water is present at the fuel filter, it has likely also entered the injection system. To flush water from the injection system, drain water accumulation from fuel tank, replace the fuel filter, and operate the engine for several minutes.

— Install fuel storage tank filter to further protect engines by filtering out dirt, rust, and scale.

IMPORTANT: The filter should not be used in conjunction with fuel tank pumps of more than ⅓ horsepower (0.25 kW). Also, install a shut-off valve between the tank and filter. The filter element should be changed yearly, or more often if fuel flow is restricted.

Lubrication system

— Change oil and oil filter before cold weather arrives.

— Use proper viscosity oil recommended for use in winter operation.

Air intake system

— Inspect entire air intake system for openings that could draw in unfiltered air (loose clamps, cracked hoses, etc.).

— Inspect dry element type filters—clean or replace if clogged with dust or dirt. Inspect for damaged seams and pleats. Replace if damaged.

— If machine is to be operated in blowing snow, consider a precleaner attachment on the air intake system. This attachment prevents blown snow from entering the air cleaner element, which would result in loss of power, excessive fuel consumption, and possibly oil consumption.

Cooling system

Maintaining the proper mixture of antifreeze and water is mandatory for proper cooling system operation in subfreezing temperatures. But that alone will not provide all the protection necessary.

For example, continued use of the same coolant depletes the corrosion inhibitors and chemical additives. Without these inhibitors and additives, rust and scale form in the cooling system and reduce cooling efficiency. Also, cavitation erosion may occur, which can lead to early engine failure.

If antifreeze breaks down, a heavy sludge may form in the radiator. This can severely restrict water flow and result in less efficient cooling.

Before cold weather develops:

1. Drain cooling system.
2. If old coolant is dirty and rusty, clean entire system using a heavy-duty cooling system cleaner.
3. Replace radiator hoses that are cracked, soft, or swollen. Also inspect heater hoses (if so equipped) and replace if necessary.
4. Check for proper operation of thermostats.
5. Clean dirt and trash from outside of radiator to allow unrestricted flow of air. Check that radiator is clean by holding light behind the core. If light is not clearly visible through the entire area of the radiator, clean it again.

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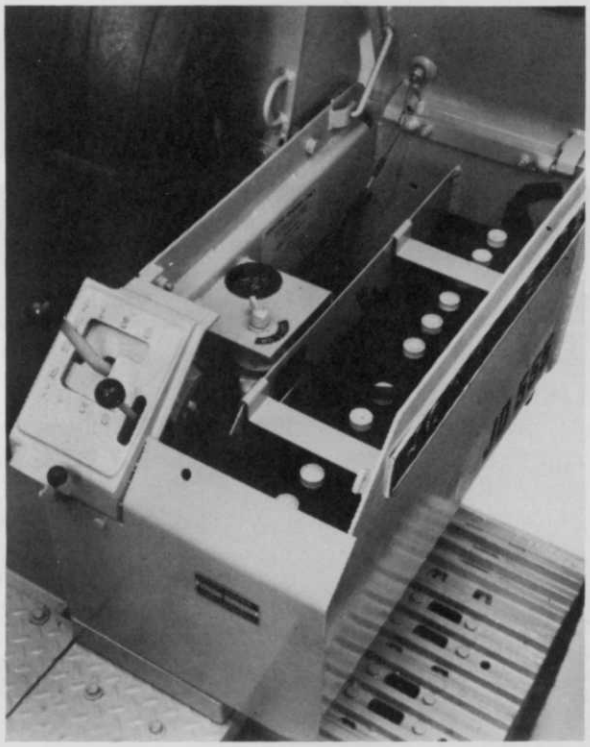

The heart of an electrical system in power equipment is the battery. It must be kept fully charged to provide maximum cranking power and prevent freezing of the battery solution.

6. Check baffles around radiator and fan shroud to see that they are in place and functional.

7. Fill cooling system with proper mixture of clean water and permanent antifreeze with ethylene glycol base. Mixture should be adequate to protect to the lowest temperatures expected. Do not use antifreeze with stop-leak or sealer additives.

8. If engine is equipped with coolant conditioner filter, perform service as recommended in operator's manual.

9. Inspect belts and replace those showing damage and excessive wear. Check for proper belt tension to assure proper coolant and air flow.

Electrical system

The battery is the heart of the electrical system. Typical batteries contain a number of individual cells enclosed in a hard rubber or plastic case. These cells are made up of a series of positive and negative plates with plate separators. Plate straps, welded to a number of similar plates, form positive and negative plate groups.

Dry-charged batteries come from the factory with no electrolyte added to the cells. Wet-charged batteries contain an electrolyte solution. The electrolyte is a solution of sulfuric acid and water, and a dry-charged battery becomes wet-charged when electrolyte is added.

A chemical reaction between the battery's plates and the electrolyte converts chemical energy into electrical energy. The reaction causes positive and negative charges of electricity to build up on their respective positive and negative plates. Battery cells reach a fully charged condition because of the electrolyte interaction with plate material: the longer the interaction, the greater electrical charge on each plate.

When the battery is connected to a complete circuit, current begins to flow from the battery and the discharge cycle begins. After batteries experience a number of charge-discharge cycles, or become discharged, they should be tested.

Typical tests include:

- Visual inspection — for general condition
- Specific gravity test — for battery charge
- Light load voltage test — for comparing cell voltages
- High rate discharge test — for internal conditions

Batteries that are questionable after any of these tests should be either recharged or replaced. Generally if all cells test the same, the battery is good. If all cells test low, recharging is usually all that is required.

If there is a real difference between cells, the battery generally must be replaced. The electrolyte specific gravity should be 1.270 at 80° F (27° C). This means it weighs 1.270 times more than water. For every 10° F (6° C) above 80° F add four gravity points (0.004), for every 10° F below 80° F subtract four gravity points (0.004). Specific gravity should not vary more than 0.050 between all cells. Voltages should not vary more than 0.050 volts between all cells under a light load test.

Battery efficiency is greatly affected by temperature. The point is—keep the battery fully charged. A half-charged battery at 0° F (-18°C) provides very little useful cranking power; its performance will be only approximately 20 percent of a fully charged battery. Battery charge must also be maintained to prevent freezing of the battery solution during cold weather.

The electrical charge of a battery can be restored by sending a direct current through the battery (from an outside power source) in a direction opposite to the direction of discharge. The reverse flow rebuilds the electrical charges on the plates.

Batteries are usually recharged automatically by the battery charging alternator or generator operated by the engine.

Stored, wet-charged batteries should be recharged at least every 30 days. If not, the effects of self-discharging and sulfate-crystal buildup on discharged plates can cause enough damage that the battery can never be restored to a normally charged condition.

Preventive maintenance can be the determining factor in whether a battery starts an engine. The following maintenance suggestions also may lead to longer battery life.

1. Proper mounting eliminates most battery vibrations. Continuous vibration loosens battery plates, wears holes in separators, and cracks the case and cover.

Secure mounting in hold-down trays with plates at right angles to the direction of movement eliminates most vibration damage. Overtightening of hold-down brackets, however, can put undue strain on the case and cause it to crack.

2. Clean battery connections permit better charging and easier starting. Use cleaning tools to remove corrosion and brighten connectors.

Clean the battery case with a baking soda-water solution. Apply this solution until foaming stops and then rinse with water. Make sure no solution enters the battery cells.

3. Electrolyte should always be visible above the plates. Constant overcharging results in low electrolyte level, and plates tend to deteriorate rapidly. Also, added stress is placed on the generator or alternator.

Overfilling results in electrolyte seepage from vent holes in filler caps, possibly causing equipment parts to corrode and rust.

4. Overcharging can warp plates and cause bubbling and loss of water in the cells. Active material bubbles from the plates and reduces battery capacity. A symptom of overcharging is a battery that uses an excess amount of water with no apparent leaks in the case. The specific gravity of the electrolyte will indicate battery charge.

Undercharging causes formation of a sulfate coating on battery plates. This sulfate inhibits the conversion of chemical energy to electrical energy and, therefore, permanently weakens the battery.

The heart of the electrical system stimulates the other parts of the system. Proper care and maintenance of batteries results in longer battery life and better performance.

Hydrogen gas present in all lead-acid batteries is

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highly explosive. And if the battery electrolyte level is low, larger quantities of hydrogen gas can become trapped in the space above the electrolyte in each cell. The slightest spark can cause an explosion. You could be injured by the explosion and also sprayed with the sulfuric acid electrolyte.

Here are five steps to use when connecting a booster battery:

1. Remove cell caps from both batteries to allow hydrogen gas to vent. Important: Ensure that both batteries are of the same voltage.
2. Connect one end of the first jumper cable to positive (+) terminal of the booster battery and the other end to the positive (+) terminal of the weak battery. When connecting positive (+) to positive (+), be sure not to touch the other end of the cable to any part of the machine, or battery damage may result.
3. Connect one end of the second jumper cable to negative (-) terminal of booster battery.
4. Connect the other end of the second cable to the starter ground or to the machine frame well below level of the battery. (If this is not possible, make this last connection as far from the battery as possible.) Then if a spark is produced at this connection, it will occur below any hydrogen gas escaping from the battery.

NOTE: For added safety, lay a piece of heavy nonconductive material over top of battery.

5. Disconnect batteries in just the opposite order. Remove the second cable from where it was last connected as described in Step 4.

Engine coolant heater

A coolant heater may be installed to aid starting in cold weather. When the heater is connected to an electrical outlet, the coolant is heated and keeps the engine warm for easier starts in extremely cold weather.

Remember, an engine block heater heats only the coolant, not engine oil. After starting the engine, allow sufficient time for oil to warm to operating temperature before placing engine under full load.

Other major components of the machine must be ready to function in the cold temperatures as well as the engine. Here are some suggestions for winterizing these other systems.

Winter work can be stunted and halted if equipment has not been checked and properly maintained.

Transmission

— Inspect transmission for external leaks and repair as necessary.

— Drain oil and refill with specified new oil. Use winter grade oil if required for specific applications. Also, change transmission oil filters.

— Examine the oil and filter for signs of contamination or metal particles that would indicate damage somewhere in the machine. Contact your dealer for assistance in determining the extent of damage and repair that will be required.

— Check the condition of hoses, steel lines, and connections.

— Make sure the transmission, reverser, and axle assembly breather are open. If there is an indication of excessive oil carryover out the breather (oily dirt around the breather), clean the breather.

On machines equipped with drive-line brakes:

1. Check for oil leakage on drive-line mounted brake.
2. Adjust brake actuating linkage.
3. Lubricate linkage and lever to prevent binding and rusting.
4. Replace brake friction element if excessively worn.

Hydraulic system

— Examine system for external leakage—repair or replace components as necessary.

CAUTION: Use a piece of cardboard or wooden guard when inspecting for high-pressure hydraulic leaks. Fluid is under pressure that is great enough to penetrate skin and cause severe injury.

— Drain hydraulic oil. Check for excessive contamination and metal particles. If present, determine the source of the contamination and correct the problem.

— Install new hydraulic oil (winter grade if recommended) and new filter.

— Check pressure cap (if so equipped) for proper operation.

— Inspect hoses and tubes for deterioration, kinks, and/or damaged fittings.

— Check position and tightness of clamps.

— Clean breather assembly if dirty.

— After starting engine, warm up hydraulic system to obtain normal function speeds by operating functions through complete cycles. When a function reaches the end of its cycle, continue to hold the function control in that direction for a few seconds (relief valve opens). This procedure is for machines with open center system only.

IMPORTANT: Do not hold function control more than 10 seconds after function reaches the end of a cycle or valve spool may heat up and stick in valve bore.

Attachments

— Grease pin joints at end of shift when joints are warm and take grease easier. If pins will not take grease, remove and clean grease fittings and grease passage.

— Replace worn pins and bushings.

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— Tighten loose hardware on attachment mounting structure.

Antifreeze

In cold weather, cooling systems must be protected by adding antifreeze—usually an ethylene-glycol type. When extremely cold weather is expected you might think the more ethylene-glycol antifreeze you add, the lower the freezing point of the coolant. Not so!

The lowest freezing point obtainable is when the water-antifreeze solution contains about 67 percent antifreeze (protects to -94° F, -70° C).

General inspection

Some miscellaneous items should be inspected if equipment is to be operated in winter weather.

— Check tires and rims for damage. A tire with a rim that was nicked or bent during the summer may retain air during warm weather but leak in subzero temperatures. Replace or repair damaged tires or rims as necessary.

— Replace broken windows and seals around doors and console (cab equipped machines). Snow that enters control areas could cause icing as temperatures fluctuate. Cold air results in operator discomfort.

— Make sure brake lights, turn signals, rotating beacon, and warning lights operate properly if machine is to be used for snow removal.

— Check operation of heater (if so equipped). Since heater is not used during summer, controls may corrode or bind up and heater will not function properly when needed.

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and hollowness can be detected. Even relative growth rates can be measured. Dr. Shortle emphasized that the most difficult aspect of using the Shigometer is interpreting the results. Only by understanding how the relative conductivity and not the absolute conductivity varies can the readings be properly interpreted.

The afternoon session of the second day turned to the mechanics of tree evaluation. James Kielbaso of the Department of Forestry at Michigan State University quickly outlined the procedures to be followed. The entire group then went outside and made practice evaluations of six trees in the Ohio State University Campus. A thorough discussion of the results occupied the morning hours of the next day.

On the evening of the second day, Jack Siebenthaler, horticultural consultant, discussed nursery appraisal. Through case histories, Mr. Siebenthaler gave the audience an idea of the type of problems involved and the methods he used to make a usable and accurate evaluation. **WTT**