2006 Snowmobile Technical Update

TECH TIPS — *Subject:* Storing Gasoline in Snowmobiles
Model: All Models

Storing gasoline does not automatically change its basic properties or performance characteristics. When done properly, gasoline can be stored for extended periods of time. Even the manufacturers say you can store their gasoline for up to a year "provided you use a sealed, non-vented container and store it in a cool, dry location that does not experience wide temperature changes." You can see that a snowmobile's fuel tank and fuel system doesn't meet the above requirements. Those same manufacturers say that the maximum storage period falls to about 30 days when stored in your average snowmobile. This is due to the fact that the snowmobile's fuel system is not sealed. Sleds are usually stored from Spring through Fall in warm and humid conditions and often under wide temperature changes. Consequently, a snowmobile experiences some of the worst possible conditions of any type of motorsport product when fuel is left in it for more than 30 days.

The situations below explain some of the bad affects that can happen to gasoline that is left sitting in a snowmobile too long. The information comes directly from the gasoline manufacturers and sheds some light on why it is so important to drain the fuel system if the unit will not be used for a length of time.

Volatility and Light Ends
Volatility describes a gasoline's ability to form vapors. Liquid gasoline does not burn; only gasoline vapors burn. So, gasoline manufacturers must include a mixture of components called "light ends" that promote vaporization of the fuel. The light ends are what allow the fuel to ignite easily at first start-up whenever the engine is cold. As temperatures get colder, more light ends are needed to ignite the fuel.

This is one reason why the volatility of gasoline is tailored for the range of temperatures expected in the region where it is sold. "Winter gasoline" has a higher volatility or more light ends for easy starting in cold weather. Conversely, "Summer gasoline" has a lower volatility because less light ends are needed. Using less light ends also reduces the amount of vapors that escape to the atmosphere and contribute to smog formation.

In order to start a cold engine, enough light end must be present in the gasoline to vaporize at the engine's temperature and form a combustible vapor-air mixture. The colder the engine's temperature at start-up, the more light ends are needed to ignite easily when the engine is cranked. When temperatures drop to snowmobile season levels, light ends become critical for cold starting.

Evaporation – Loss of Light Ends
The gasoline light ends needed for easy starting vaporize during storage just as they do during normal use. If the storage container is not sealed tightly, some of the light ends will gradually be lost. Too great a loss decreases the gasoline's ability to start an engine again, especially in colder temperatures.

During storage, evaporation of gasoline from a vented fuel tank can be minimized if the temperature of the vehicle is kept constant. Temperature changes can cause the temperature of the tank to cycle. The heating portion of the cycle raises the pressure of the gasoline vapor and air above the liquid gasoline, which, in turn, drives some of the vapor-air mixture out through the vent system. The succeeding cooling cycle lowers the pressure vapor and air, drawing fresh air back into the fuel tank. Light ends evaporate from the gasoline and saturate the new air. The repetition of the cycle gradually pumps light ends out of the gasoline inside the tank. Since the fresh air being drawn into the fuel tank also contains moisture, especially during periods of high humidity, the cycling of the air also brings water vapor into the fuel tank. If the water vapor condenses during the cooling cycle, it ends up as water in the fuel. Since high humidity is common, during the summer storage season, water in the gas and corrosion in the fuel system is another potential problem.

The larger the surface area of the gasoline exposed to the air, the more vaporization occurs and the more light ends will be lost. Higher temperatures and wider changes in temperature also increase light end loss. So, keeping the container full and controlling the temperature fluctuations will minimize the loss of light ends, the exposure of gasoline to the air, and the contamination of the gasoline with water.

Oxidation – Formation of Gum

Except for added oxygenates, gasoline is made up almost entirely of hydrocarbons-molecules that are constructed from hydrogen and carbon. Hydrocarbons, as a class , are chemically stable molecules. However, there are types of hydrocarbons in gasoline (olefins and diolefins) that can combine slowly with the oxygen in the air and cause oxidation. The products of this reaction are larger molecules called "gum."

Warmer temperature also accelerates formations of gum. This is another reason why it is recommended to control the temperature of stored gasoline. Most gasoline contain negligible amounts of gum when they are manufactured, and most contain chemicals called "stabilizers" that retard gum formation. It is the stabilizers that make it possible to store gasoline for a considerable time period when the conditions are good.

Soluble Gum

The gum formed by oxidation is usually soluble in gasoline. However, it remains behind as a sticky residue when the gasoline evaporates. Since gasoline begins to evaporate in the carburetor of a carbureted engine or in the injector of a fuel-injected engine, a gasoline containing soluble gum may leave a deposit on these parts and on the intake valves. These gum deposits will be in addition to the normal deposits formed by gasoline which are triggered by higher engine temperatures.

Engines run best when vital engine parts are clean. Carburetor and fuel injector deposits can cause hesitation and stumbling on acceleration, lower fuel economy, lower power output, and higher emissions of hydrocarbons and carbon monoxide. Excessive intake valve deposits can cause many of the same performance problems, plus higher emissions of hydrocarbons, carbon monoxide, and nitrogen oxides. The EPA recognizes that fuel system deposits increase emissions, so they require all gasoline to contain a deposit-control additive. All deposit-control additives keep deposits from forming; the best ones clean up deposits formed by lower-quality gasoline.

If the gasoline contains a lot of soluble gum, the normal level of deposit-control additive may not be sufficient. This is why it is sometimes recommended to treat a tank of gasoline with an extra dose of deposit-control additive if a vehicle displays driveability problems after being stored. The gum-forming reactions become faster as the temperature of the gasoline increases.

Insoluble Gum

Severe oxidation of gasoline may produce insoluble as well as soluble gum. The insoluble gum will take the form of brown or black particles which float in the gasoline or settle to the bottom of the container.

When an engine is fueled with gasoline containing insoluble gum, the fuel filter will remove the gum. If the engine has an in-tank fuel pump, the screen on the pump's feed also may capture some of the gum. However, these devices can become plugged if the gasoline contains too much insoluble gum. This will cause the engine to lose power or stall because it is starved for fuel. Adding a deposit-control additive will not keep insoluble gum from plugging filters and screens.

Conclusion

The information above makes clear the following recommendations:

- Avoid leaving fuel in a snowmobile for more than 30 days unless it is in cool and dry location and won't see wide temperature changes.
- If fuel must be left in the sled, use fuel stabilizer in the tank and be sure to run it through the system. Fill the tank with fuel and drain the carburetors.
- Warm and humid weather is the worst possible condition for storage, Anytime the sled is parked, it should be in a cool and dry location that won't experience wide temperature fluctuations.