

Dependable Cold-Weather Performance

Many consumers use the fall months to prepare their vehicles and equipment for winter. If there's a weak point in a vehicle, it seems as though the cold will find it and create problems. Plastic becomes brittle, fuel and lubricants can gel and extreme cold is just plain hard on things. The winter months bring unique challenges for lubricants and are great for showcasing the enhanced performance benefits of AMSOIL synthetic lubricants. Conventional lubricants are far more susceptible to the effects of extreme temperatures. Extreme cold at startup can cause oils to thicken, starving vital moving parts of necessary lubrication. In many cases the motor oil will thicken to the point that the vehicle will not start. Many motorists let vehicles idle for extended periods to warm the interior and defrost the windows. Others create extreme heat in the engine by plowing or getting stuck in deep snow. These are just a few examples of the many challenges lubricants face in a typical North American winter. AMSOIL synthetic lubricants are formulated for maximum cold-temperature performance, allowing quick starts, superior protection and versatility.

Keep Engines Protected

AMSOIL synthetic motor oils provide superior protection and performance in cold-weather applications. They dramatically outperform conventional petroleum motor oils, especially in the cold.

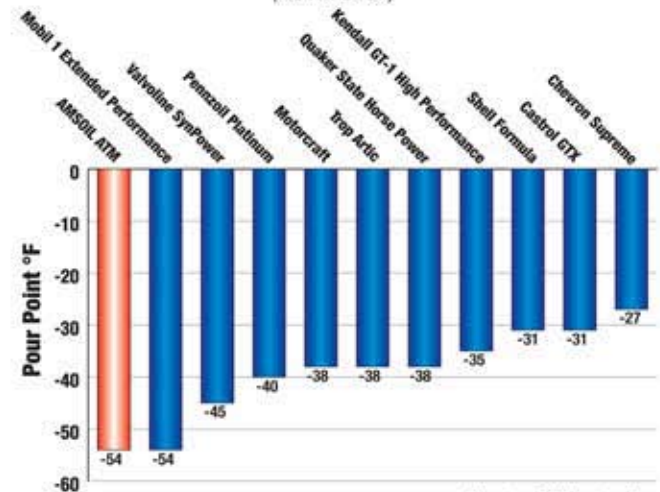
Conventional petroleum lubricants often contain paraffins (wax). While modern refining techniques remove most of the wax from petroleum oil, some wax-like molecules remain. These wax-like molecules are soluble at ambient temperatures above freezing, but crystallize into a honeycomb-like structure at lower temperatures and cause oil circulation problems. At startup, this can leave working parts unprotected for as long as five minutes while the oil warms to a temperature that allows it to flow. AMSOIL synthetic motor oils provide outstanding low-temperature fluidity for fast, dependable winter starts and immediate startup protection. In addition, their superior synthetic multi-viscosity formulations allow AMSOIL motor oils to provide exceptional high-temperature protection in hard-working vehicles used in severe-service winter applications.

Pour point is an indicator of an oil's ability to flow at cold operating temperatures. It is the lowest temperature at which the fluid will flow. Pour point depressants keep wax crystals in the oil

microscopically small to keep them from joining together to form the honeycomb-like structure. They lower the temperature at which oil will pour or flow and are found in most motor oils designed for cold-weather use. As synthetic motor oils do not contain those wax crystals, they tend to offer better cold temperature protection properties. In fact, the following chart comparing AMSOIL Synthetic 10W-30 Motor Oil (ATM) with several competitive products shows that AMSOIL synthetic motor oil remained fluid down to -54°F .

POUR POINT

(ASTM D-97)

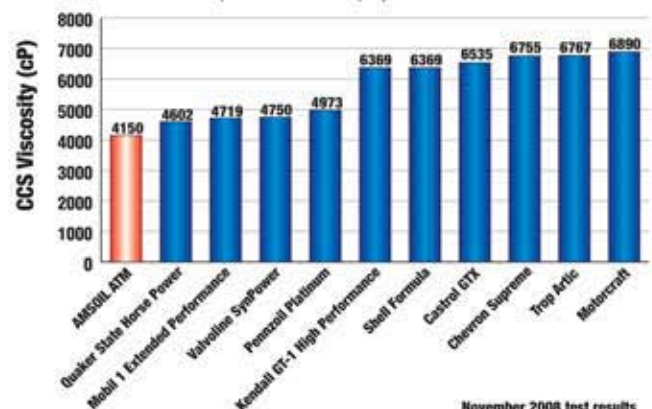


November 2008 test results

AMSOIL offers several other lower-viscosity motor oils with even lower pour points for maximum cold-temperature performance, including AMSOIL Synthetic 5W-30 Motor Oil (ASL) (-58°F), AMSOIL Signature Series Synthetic 0W-30 Motor Oil (SSO) (-60°F) and

COLD CRANKING VISCOSITY

(ASTM D-5293) $\text{cp}@-25^{\circ}\text{C}$



November 2008 test results



AMSOIL 0W-20 Synthetic Motor Oil (ASM) (-65°F). AMSOIL synthetic motor oils help engines turn over easier and flow quickly to engine parts for critical startup protection. Engines start faster and wear is greatly reduced for extended engine life. AMSOIL motor oils are available in wide viscosity ranges for optimum performance year-round.

The Cold Crank Simulator Test determines the apparent viscosity of lubricants at low temperatures and high shear rates. Viscosity of lubricants under these conditions is directly related to engine cranking and startability. The lower a lubricant's cold crank viscosity, the easier an engine will turn over in cold temperatures. The low cold-crank viscosity of AMSOIL synthetic motor oil reduces drag on moving engine parts and allows engines to achieve critical cranking speed in frigid temperatures. Engines turn over quickly and dependably in the coldest winter temperatures and motor oil flows to critical areas requiring immediate lubrication, protecting against wear at startup.

Beyond Motor Oil

Gear lubes face many of the same cold-weather challenges as motor oils do, and the same basic differences between conventional and synthetic products apply to them as well. Synthetic gear lubes inherently possess superior cold-weather performance characteristics and more readily provide dependable protection. While engines, transmissions and cooling systems use heat created by combustion to warm up, gear oils rely on friction to warm up, which is only generated once the gears begin to move. This initial movement in cold weather is the point at which gears are most susceptible to damage.

As temperature decreases, the viscosity of oil increases. Gear lubricants with high viscosity at cold temperatures are less efficient, and the gears require more energy to turn. Gears and bearings in the differential and axle housing are splash-lubricated, and



gear lubricants that are too thick at cold temperatures can channel and starve internal components of lubrication, which can cause failure. AMSOIL Severe Gear Synthetic Gear Lubes possess excellent cold-flow properties, as evidenced in Brookfield Viscosity Test results. Extensive testing, the results of which are available in the AMSOIL *A Study of Automotive Gear Lubes* White Paper (G2457), and real-world experience have proven the Severe Gear line's ability to deliver exceptional performance and protection at extremely low temperatures.

Fuel Additives That Perform

Diesel applications can be especially sensitive to cold-weather issues. As the temperature drops, the wax naturally found in diesel fuel begins to form crystals. The point at which wax crystals form is known as the cloud point. These wax crystals eventually clog the fuel filter and starve the engine of fuel, preventing it from starting. While low-quality fuels may form wax crystals in temperatures as warm as 40°F, most fuels have a cloud point near 32°F. The point at which the wax crystals clog the fuel filter is known as the cold filter-plugging point (CFPP). AMSOIL Cold Flow Improver (ACF) lowers the CFPP by as much as 34°F in ultra-low-sulfur diesel fuel (ULSD).

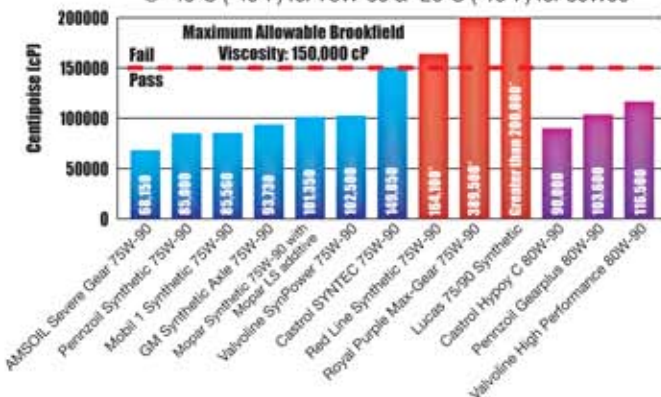
AMSOIL also offers Diesel Concentrate Plus Cold Flow Improver (DFC): a convenient combination of two fuel additives in one bottle. Diesel Concentrate Plus Cold Flow Improver delivers improved efficiency and cold-temperature performance.

While Cold Flow Improver helps prevent diesel fuel from gelling in cold temperatures, AMSOIL Diesel Recovery (DRC) is an emergency diesel fuel treatment that dissolves the wax crystals that form when diesel fuel has surpassed its cloud point in applications not treated with Cold Flow Improver. Diesel Recovery liquefies gelled diesel fuel and thaws frozen fuel filters, avoiding costly towing charges and getting diesels back on the road.



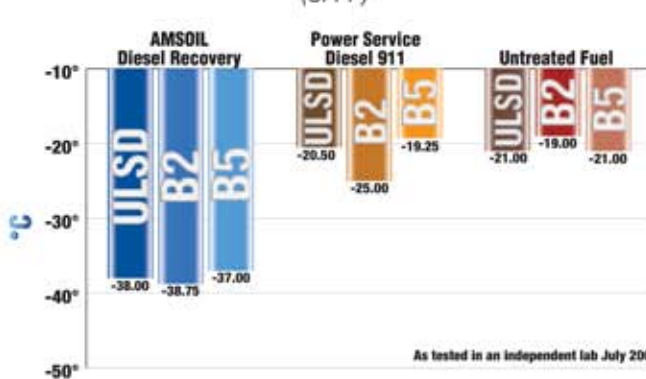
BROOKFIELD VISCOSITY

@ -40°C (-40°F) for 75W-90 & -26°C (-15°F) for 80W90



COLD FILTER-PLUGGING POINT

(CFPP)



As tested in an independent lab July 2009