

ASTM D445-06 Standard Test for Kinematic Viscosity

UW Madison Formula SAE

Abstract:

Advancements in synthetics and organic oil refinement have led the UW- formula SAE team to test how an oil additive could affect engine output and overall lubrication potential. An oil additive named Star-Tech made by CMW Oil Company proprietary for North Star Automotive Group was tested via dynamometer trials and was found to produce higher horsepower and torque. Kinematic viscosity tests were performed using a Cannon kinematic viscosity tester and ASTM standards at the Cummins Filtration Tech Center. It was found that the oil additive had a 3.98 times higher kinematic viscosity than Mobil 1 10W-40 4T racing oil and 3.82 times higher viscosity than AMSOIL.

Introduction:

Oil additives have usually been an area full of empty promises of more lubrication and horsepower. However, over the years advancements in oil refining and synthetic processes have helped developed new oils and additives. One such oil is called Star-Tech, produced by CMW Oil Company (who also builds racing engines for GT-1 Porsches in the American LeMans Series) made proprietarily for the North Star Automotive Group. The oil was developed to help fight wear during endurance races like the 24 hours of LeMans. In an effort to maximize engine output the UW-Madison Formula SAE team tested the oil and its potential benefits. Based on dynamometer testing, the oil produced consistent gains in torque and horsepower with the first run. Such a noticeable gain in power in back to back testing made more testing necessary. The primary concern was that the additive simply thinned the oil causing a reduction in viscous friction in the hydrodynamic engine bearings.

Procedure:

Several methods exist to test the viscosity of a fluid. However, kinematic viscosity testing at varying temperatures would help show if the additive had viscosity breakdown especially at increasing temperatures. The ASTM D445-06 test was chosen to be performed as data produced would be immediately comparable to other oils on the market as well as those the SAE team currently uses.

The test is relatively simple and follows a basic procedure. The oil is placed into a calibrated glass viscosity tube. It is allowed to settle overnight and is submerged in a warm bath at 40 degrees Celsius. Then the fluid is sucked up a portion of the tube to the highest line on the right side of the tube seen in Figures 1 and 2. Once the oil's meniscus touches this line a timer is started and continues until the oil's meniscus touches the lower line. This is then repeated up to three times and then the bath is increased to 100 degrees Celsius and the test is performed again up to three times.



Figure 1: Close up of test in progress

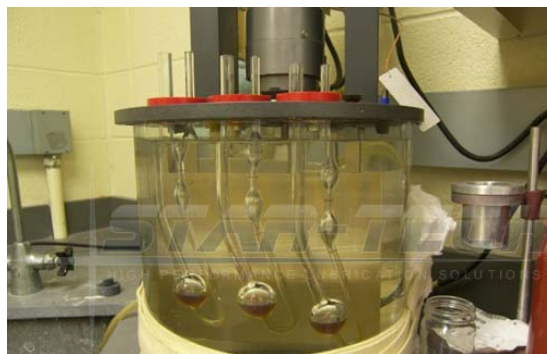


Figure 2: Entire Cannon Viscosity test setup.

The time intervals are then converted into seconds and multiplied by a constant that is specific for the glass viscosity tube used. This number is then the kinematic viscosity of the fluid. It should also be noted that different calibrated constants exist for the same glass piece with temperature changes.

Analysis:

Star-Tech Oil Additive					
Tube Size	300				
Tube Number	206F				
Test Temp. [C]	Trial	Constant [cSt/s]	Efflux Time [s]	Kinematic Viscosity [cSt]	Average [cSt]
40	1	0.2304	2682	617.9328	617.8176
40	2	0.2304	2681	617.7024	
100	1	0.2292	240.04	55.0172	55.0546
100	2	0.2292	240.37	55.0928	
100	3	0.2292	240.2	55.0538	

Table 1: Raw data from testing.

Comparitive Analysis		
Brand	Test Temp. [C]	Average Kinematic Viscosity [cSt.]
Mobile 1 Racing 4T 10W-40	40	86
	100	13.8
AMSOIL High Performance 10W-40	40	84.5
	100	14.4
Star-Tech Oil Additive	40	617.8176
	100	55.0546

Table 2: Comparisons with top tier oils.

Conclusions:

From the data tables in the analysis tables it can be seen that the additive is much more viscous than other oils used by the Formula SAE team and that of comparable caliber. It can thus be concluded that during our initial testing of the oil viscosity breakdown is not occurring. However, much more testing needs to be performed such as ASTM D4172 which is known as the Four Ball Wear Test. This basically tests the oil's breakdown characteristics at varying rotational speeds and temperatures. The oil does show much potential and has gotten the attention of many.

