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## SPECIAL REPORT:

## VALVOLINE'S NEW BRIGGS & STRATTON RACING OIL

BRIGGS & STRATTON

### RACING OIL

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# PUTTING VALVOLINE'S NEW KARTING OIL TO THE TEST

## RACERS NORMALLY LOOK AT OIL ONE OF TWO WAYS.

They feel that they know what works and their minds couldn't be changed, even with force, or they constantly change brands of oil trying to find a competitive edge. I tend to fall somewhere in between these two extremes. Historically, I know what has worked for me, and the expense associated with a failed engine wasn't worth the risk of experimenting. But, when Valvoline came to me and asked if I would do an unbiased test of their oil, I gladly accepted. With Valvoline being deeply involved in almost all aspects of racing, it was just a matter of time before they applied their long acquired knowledge into the karting world.

I was excited to hear that they took notice to the importance of karting in motorsports. One thing I knew, and stated up front was how splash lubricated kart engines are not the same breed as full pressure lubed engines. I have tried oil in karting that I have used with great success in high performance car applications only to see all my hard work come crashing through the back of the engine. Valvoline assured me that this product was far enough along in its development that I wouldn't have to worry about this. Actually, they stated from the beginning, that the 4 years of development that went into this product made it the best of any available oil kart today. Opinions aside, my goal from the beginning was to get real engine results, I was not concerned with commonly stated claims.

Every karting oil has the same claims: more horsepower, less temperature, and reduced wear. This makes it very difficult for the consumer to believe any of the claims. I compare it to reduced fat food. Everything these days is "low fat," at least until you read the actual label! Reduced wear



compared to what, olive oil? Believing claims without proof is not what my company is about, which is why I put together a test plan to compare this new oil to two very popular karting oils currently on the market. Brand A and B, the oils will be left anonymous. To say one oil is better than the next for all situations wouldn't be fair considering this is my test plan. But, under this test plan, all 3 oils were tested under the same conditions.

The purpose of this testing was to measure in a lab environment how the new oil compared to the

## Oil A

Oil A did not show good visual results at the end of the endurance testing. The top end was very dry and dirty, which is of some concern. The crankcase was acceptably clean and showed no real issues. But, the piston showed some discoloring on the sides of the skirts. Wear on the bore piston and rings was the worst of the 3 test oils. Oil A also had the most internal piston and chamber carbon build up, but it was not excessive considering the testing duration.

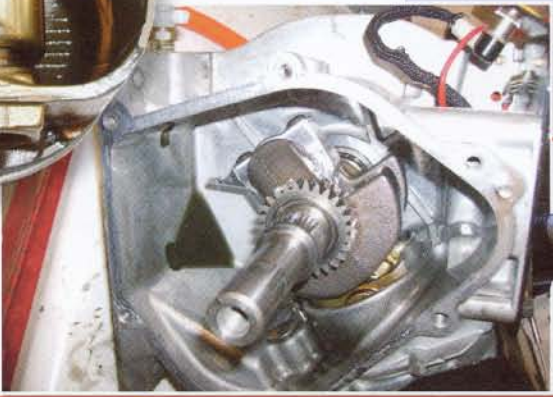




CHART 1

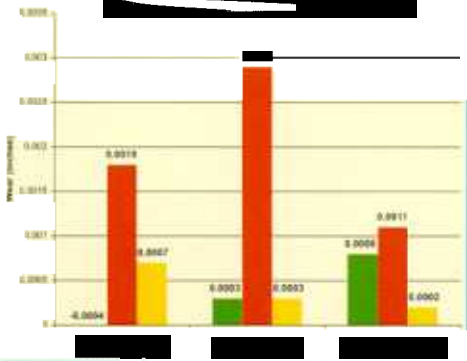


CHART 2

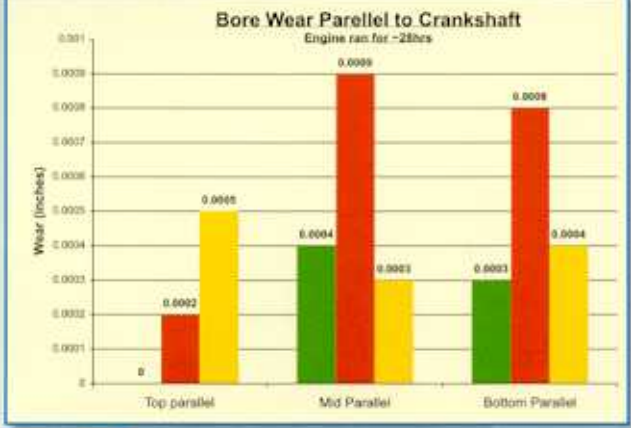


CHART 3

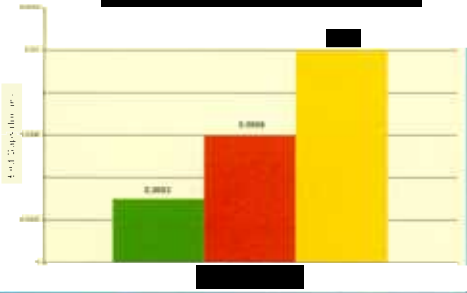
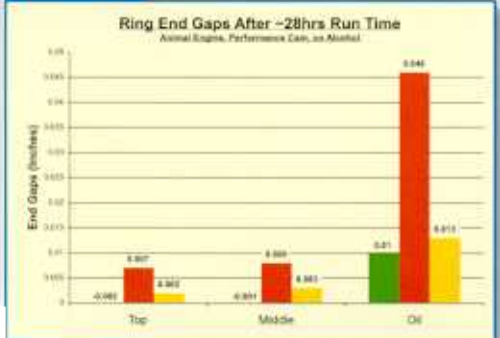


CHART 4



Charts 1-4: The wear of different areas were compared against the original pre-testing measurements. The above charts show not all the measurements, but highlight the ones that showed measurable wear, these charts represent the total amount of wear during testing. The wear on an endurance test cycle normally doesn't add up to much because of the clean environment they run in. Twenty eight hours of run time is probably equal to about 3 years of racing hours. It is interesting how an engine ran in a clean environment can show less wear when ran for 28hrs than an engine ran for 2 hours without attention paid to clean oil and air cleaners. In the end, Valvoline showed the least amount of wear, with Oil B a close second, and Oil

others in an operating engine. The test used the three most common claims as the objective for the results in the end: less wear, more HP, and reduced temperatures. The testing was formatted so that its wear was measured over time in an endurance situation. Critical engine points were measured for temperature differences under a specific test. The power output was measured, compared, and repeated for the 3 different oils.

All the tests were run on a stationary computerized water break dyno, computer controlled and ran off of the same test cycle. The engines were all new Briggs & Stratton Animals, with billet World Formula rods fitted with Comp Cams™ F275 cam. These components gave the engine around 11hp, which is similar to what a blueprinted race engine would be, but this way it didn't require all of the build time to achieve this power. The standard Animal PZ22 carburetor was used. All the tests were run on methanol because that is how the engine is raced. Well over 100 gallons of methanol were consumed during testing!

**Endurance Evaluation:**

The endurance testing was used to evaluate the wear and long-term durability of the oils. All the critical engine wear areas were measured before the test to establish a baseline to compare to the data of the completed testing. The engine was broken-in for 1.5 hrs on a progressive load and speed break-in cycle. The break-in oil used was the same as the oil used for the testing. The oil was then changed out and had fresh oil poured in for the start of the test. The engine was then power tested to

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# Oil B

F. That is how I would grade the appearance of this engine after the endurance testing. Though the oil performed adequately during the testing, the tear down revealed excessive varnishing inside the engine. It may not have any real adverse affect on the oils performance, but it sure looks bad! Notice how even the piston is excessively varnished.



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Charts 5-7 (below): Power was checked every 4 hours of the endurance cycle to monitor overall engine performance. To ensure the testing was consistent, the data was averaged and charted to monitor any changes through the duration of the testing. The Valvoline and Oil B showed the best results of the test oil. The Valvoline showed results consistent to a theoretical situation where the power increased slightly as the engine loosened up, then reached a peak and slowly deteriorated from there. This is not a quantifiable result, but it may help represent the consistency of the oils protection over time. Oil B also showed good results but did show some greater fluctuations.

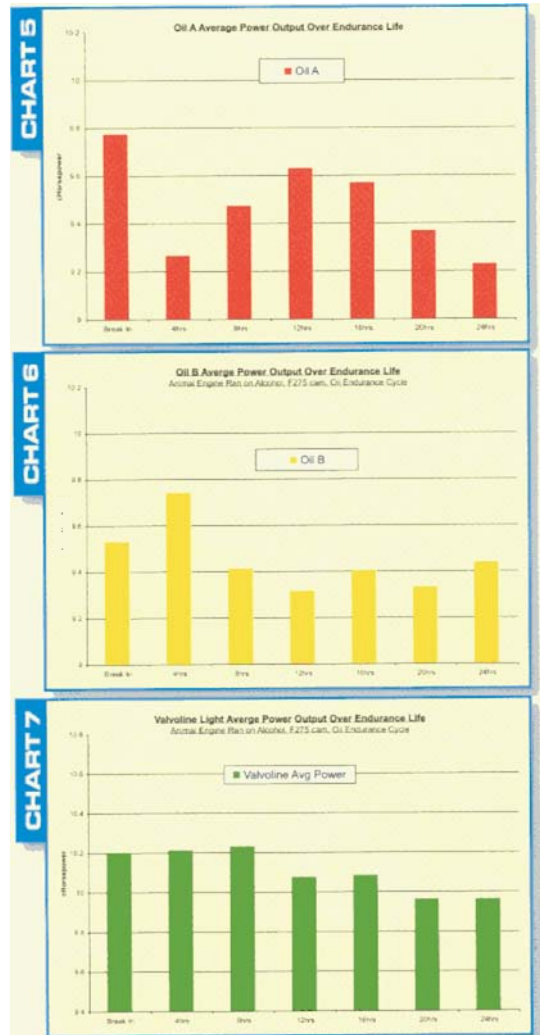




CHART 8

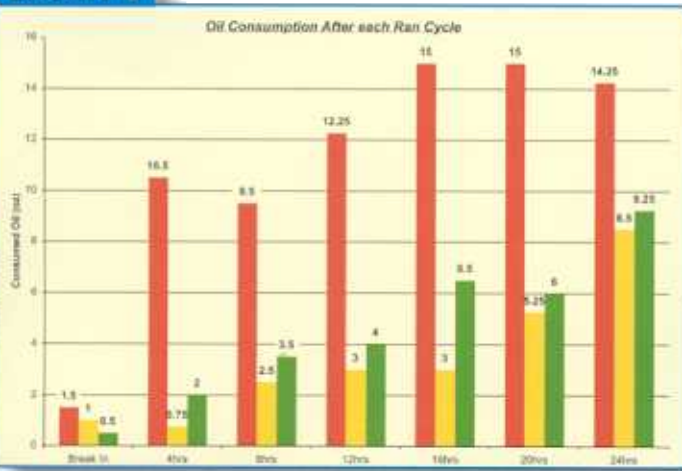


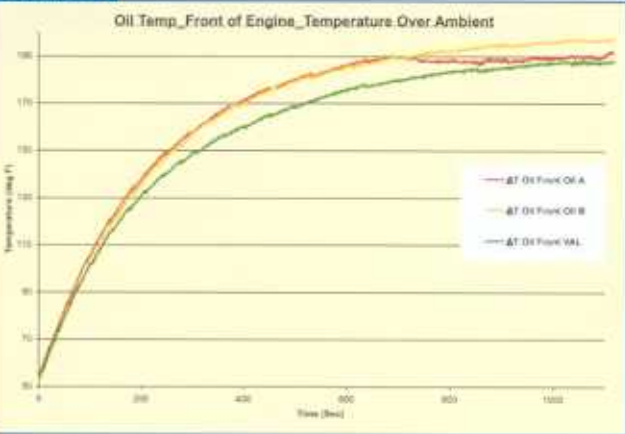
Chart 8: Oil consumption can be a major issue in endurance racing. This testing proved this point clearly. I remembered a couple of racers contacting us about how they failed their racing engines by running them out of oil after competing in a 3 hr endurance race. Originally attributed to loose oil rings, further investigation showed that when the engine is allowed to reach high operating temperature, some oils actually evaporate, or boil out the breather. When doing this testing, it was apparent by the extremely high amount of by-product coming out of the breather tube and caught in the catch can. Of the 3 oils, the Oil B showed the least consumption through the test duration, Valvoline was a very close second. Both Oil B and the Valvoline had acceptable oil consumption. While Oil A failed this test miserably, with as much as 3.5oz/hr oil consumption, it is easy to see how a 3hr race could cause an engine to fail due to lack of oil! Plus, the odor associated with the oil boiling off was extremely unpleasant. Almost thirty hours in the shop with such a bad smell left, well, a bad taste in my mouth for that oil.

- Valvoline
- Oil A
- Oil B

**The Endurance Test cycle went as follows:**

- 4000-6500rpm full load power acceleration
- 6500rpm for 17sec
- 6000rpm for 20sec
- 5500rpm for 15sec
- 5000rpm for 15sec
- 6000rpm for 10sec
- Idle for 10sec, then the 2 minute loop would start up again and repeat for 120 cycles or 4hrs total run time.

CHART 9



Continued from page 3  
 even though it performed OK during the endurance testing. The Valvoline oil was the cleanest of the group, with the least amounts of carbon build up and very little internal coloring of even the upper valve train.

**Temperature Evaluation**

The temperature of an engine is a good representation of the internal friction of the engine. A percentage of the engines energy input goes into friction and comes out as heat. Rings rubbing against the bore, bearings, and valve train components all cause heat when they are moved against each other. The energy that goes into creating this heat is power that can't be made to make

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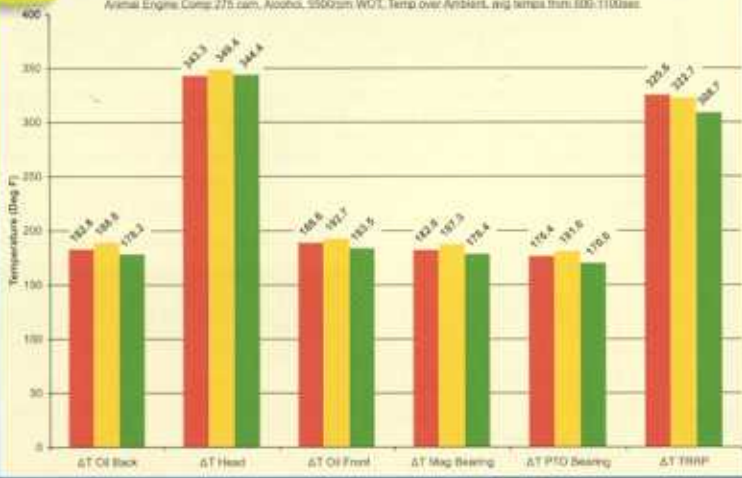
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**CHART 10**

**Measurement Points Compared-Oil A vs Oil B vs Valvoline**

Animal Engine Comp 275 cam, Aacobs, 5500rpm WOT, Temp over Ambient, avg temps from 600-1100rpm



power output similar to an "as raced" blueprinted Animal. The standard PZ22 carburetor was also utilized for the test. Testing was conducted on Methanol.

To make sure that the engine had a fair change over between oils, it was ran with 20oz of the new test oil for 10-15 minutes, after the previous oil was ran. Then the oil would be changed out again and refilled with 18oz of the new test oil once again. This gave the oil the chance to mix with any oil left in the engine and then be drained out, when replaced with the fresh oil it should of proved to be a very pure fill of the testing oil.

The temperature testing points were as follows: the oil temp was taken at the front and rear of the block through the drain fill holes, the top ring reversion point (TRRP) was taken at the top of the cylinder .100" from the bore, this is where the ring changes direction at TDC and is known to be the hottest part of the bore. Both the block and the cover were drilled to put a thermocouple against the Mag and PTO bearings. Finally, the spark plug temperature was taken at the base of the plug.

your kart go faster. To evaluate the temperatures inside the engine with the 3 test oils, critical points were thermocoupled (temperature probes) up to measure their temperatures at WOT. For this test, the same engine was used and very little time was allowed in-between testing to keep everything as consistent as possible. The calibration of the dyno temperature input was checked using a simulator and adjusted to +/- 1deg F.

The engine was an Animal run on methanol. To give the engine a little more power it also had a Comp Cams™ F275 cam installed with World Formula dual valve springs. This gave the engine



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The test was run for 10min at wide open throttle; data was recorded every second for the duration of the test. This allowed the data to be looked at not only at one point, but as a whole curve as the engine warmed up and stabilized. Comparison data was taken by averaging the area of the curve where the temperature was most stabilized. This helps to take bad data points out of the results by averaging an area of the curve rather than just one point that could have easily drifted.

Chart 9 (page 5) shows a chart of the oil temperature from the three different tests. This illustrates how you can see the warm up stage and then when the temperature starts to stabilize. The flat section of the curve is the one that is analyzed to compare the temperatures. Take notice how Oil A's temperature started to fall off after it stabilized. The reason for this is

CHART 12

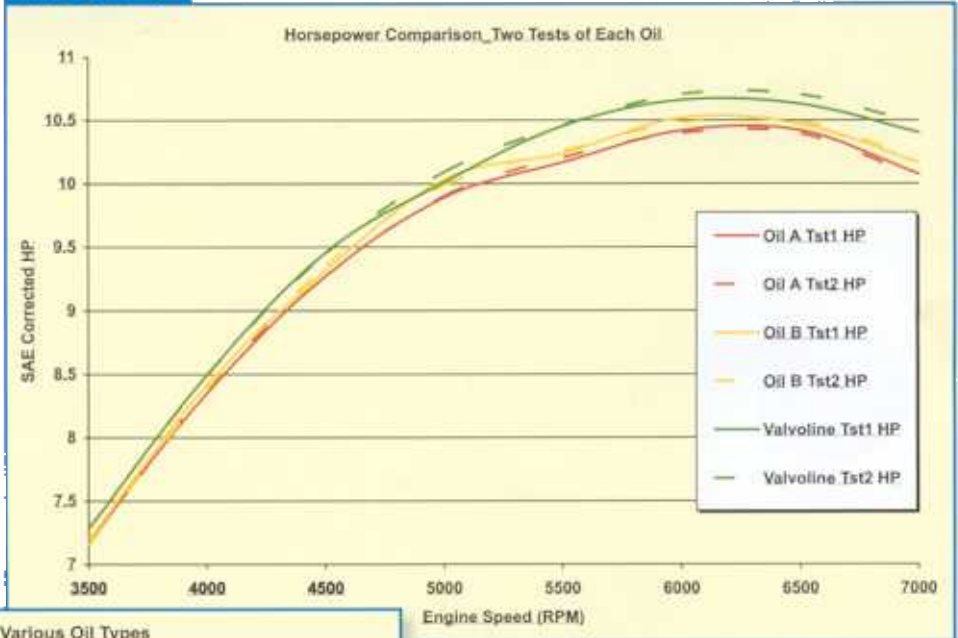
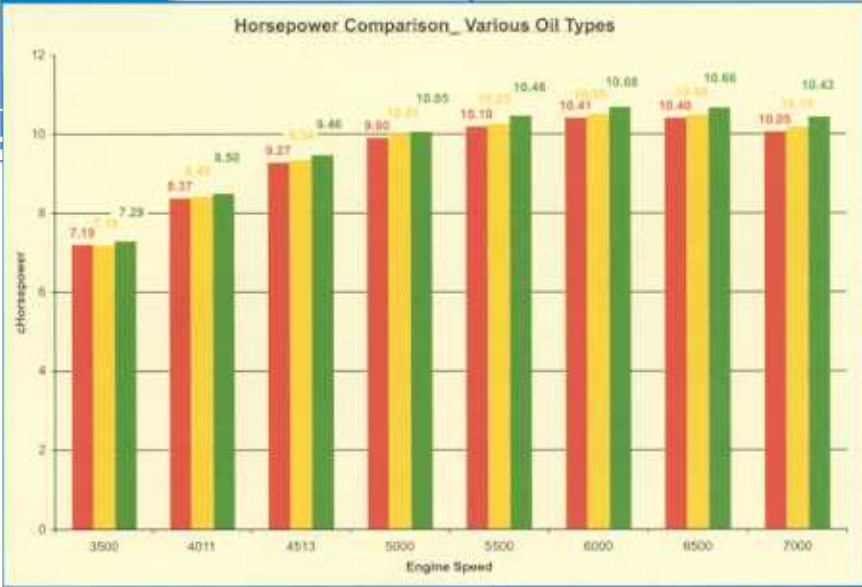


CHART 11



unknown, but showed up at most the measurement points to some degree.

Chart 10 (page 6) shows the summarized temperature data in degrees Fahrenheit. The trend showed the Valvoline oil did have measurable reduced temperatures at locations where friction would be most involved. Areas like the cylinder TRRP or the bearings show the biggest difference, while the cylinder head temp, which would be more relative to the power output of the engine rather than friction stayed relatively close between the oils.

Also notice that the temperatures are compared as the difference over the ambient, not just the measured temperature. By subtracting the ambient temperature from the measured temperature data it can then be compared, even if the air in the dyno cell is slightly different between tests. For example, if the ambient temp was 85 deg instead of 80 deg the engine would run 5 deg hotter, but by subtracting the ambient notice how the hotter one would end up having 5 deg more taken off of it to give a "delta temperature" exactly the same. This is accepted common practice for thermal evaluations of engines.

The Valvoline oil was definitely slipperier than the other 2 oils showing as much as a 10 deg temperature reduction at critical points. Ten degrees might not seem like a lot, but most karting oils on the market today are pretty good, so any measurable advantage is a good sign of a well developed product. Oil A came in second, but it wasn't until the top part of the curve fell off that it started to show better than Oil B. Once up to the stabilized temperature Oil B showed the worst results of the three.

**Power Evaluation**

This is a lot of technical talk to get to what matters most to the racer, making horsepower. Your engine takes in the same amount of energy in the form of air and fuel no matter what oil you are using. So how does it make more horsepower? By making less of the energy from the fuel go to frictional heat. Because of reduced frictional drag,

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# Valvoline

The Valvoline test oil showed the best visual results of the 3 oils. The top end by far was the cleanest and most lubricated looking. The lower end was clean and very little deposits, besides some around the lower cylinder bore, could be seen. The build up on the piston was very low. (The small spots on the piston actually came from a falling air cleaner, not the oil.) The piston and cylinder bore showed very little signs of wear, especially after having the equivalent of about 3 racing seasons on them.



more energy can be used to make more power and go faster.

The power tests were ran from 3500 to 7500rpm at 500rpm increments with 30sec at each set point. The dyno was calibrated before the testing and the results were corrected to SAE standard. Each test was started at exactly the same oil temperature. Each test was run twice back to back, to verify that the results were repeatable.

The first test, Oil A, was the rerun to verify that the results would repeat. The Oil was changed out using the same procedure as the temperature testing.

Chart 11 (page 8) shows the values of the data from the power tests. It is clear that the Valvoline also showed a gain in this department. As much as .4hp compared to Oil A! The trends made sense that as the RPM increased, and so does friction, the advantage of the better oil increases. Oil B came in second place, with Oil A just slightly below that. It was exciting to see such a measurable gain in power from just changing oil.

Chart 12 (page 8) shows the actual power curves ran on the dyno, the solid line is the test 1 and the dashed line is test 2. This shows that the results were repeatable and that the dyno readings were consistent, all curves measured with in 0.1hp between the two backto back tests of the same oil. The baseline rerun at the end (not plotted) showed a little better results than the baseline run, but was still measurably below the Valvoline



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power. It is hard to put a value on such precise testing, and some will make power claims down to the tenth of a horsepower gain. That may be true for that particular test session, but testing the same parts a different day will probably show different results. Dynamometers, engines, and ambient conditions make testing to this precision very difficult.

So how much is the oil worth in power over the other two popular oils? This I won't conclude with a number, but there was a measurable gain, even on the verge of being a significant one! Also consider that an engine with more friction points, a V-twin for example, would have more power to gain from a better oil than a blueprinted kart engine where efforts were put into reducing the frictional drag of the engine to start with. Considering how good most oils are today, it is not a matter of a value put on horsepower, just what will give you the best lap times when at the track.

In the end what did I think? Before I answer, I have to state the fact that Valvoline paid for the testing of the three oils by my company. They were only charged for the hours the testing required and there was no direction for the testing or the method used to establish the results. The results were asked to be non-biased and the point was to evaluate the product against others commonly used oils whether the results were good or bad under our conditions.

Now that this is clear, my opinion is simple, I am going to be using Valvoline oils in my race engines. Let me explain, in the introductory example I stated that my opinion on switching oils was that I stick with something I know is good until there is good reason to change. Not just one variable would have changed my mind, but looking at all the testing results and experiencing it first hand was very convincing. The fact that the oil did run cleaner, cooler, and made more horsepower defiantly got my interest up. We always like testing to make sense, and because the engine that ran the coolest also made the most horsepower, this greatly helped the results verify themselves.

Then the facts that Valvoline states the new karting oil could be formulated for use in not only splash lubed engines, but also work equally as well in full pressure lubed engines, and could even be formulated for use in two cycle engines. The oil has been in development for 4 years, laboratory and field tested to the highest standards, tested in different formulations in everything from drag cars to kart engines. We do a lot of different work in our shop, including V-twins, which I have had great luck with using the new oil so far. Being able to have one oil for a couple applications is much easier than stocking all different types of oil.

Valvoline is expected to release their new oil in February. So if you are the type that likes to always change your oil in search for the best one, I would defiantly give the new oil a try. If you are the type that is dead set on your current oil, well, good luck. Overall, I hope that this testing helps verify that their can be differences in oils, but with today's technologies, huge differences will be hard to find. Don't expect to see night and day differences from any good oil, just look for the small differences that are important and will help give you that competitive edge you need to be a winner. **TKK**