



# Engine Break-In

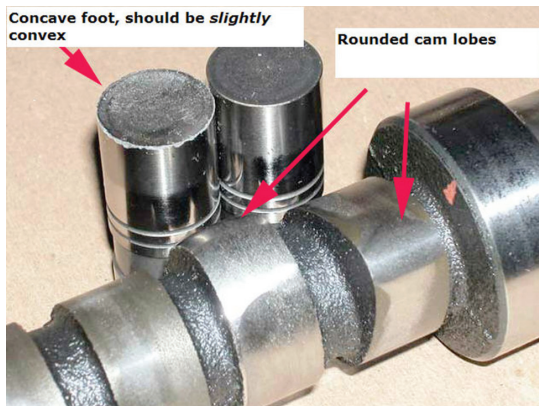
By Blaine Ballentine

“What oil should I use to break-in my rebuilt engine?” It would be nice if the answer were as simple as the question.

Part of the challenge in making a solid recommendation is that the market is really small and companies do not pour research dollars into products with little profit potential. There is not much in the way of published broad-based rigorous research.

However, we can identify some principles that help us make a choice.

There are one or two primary areas of concern



during break-in. First is seating the rings. During break-in, the rings and cylinders need to polish each other to achieve a good ring seal. If a good seal is not established during break-in the, engine may be doomed to consuming oil for the rest of the life.

The second area of concern is with a flat tappet cam. If the break-in oil's zinc content is inadequate, the relatively rough surfaces of the new cam and lifter can quickly tear each other up. The microscopic peaks in the surface of the cam and lifter can weld, transferring metal from one to the other and making the surfaces rougher. The cam lobes wear off and the engine starts running

poorly in a fairly short period of time. Obviously, this is of less concern in an engine with roller lifters.

The variables in engine break-in appear to be machining, heat and load, and oil formulation.

## MACHINING

When I researched engine break-in, one of my resources was the Lubrizol Corporation, the world's largest lubricant additive manufacturer. I sent an email to my rep, who forwarded it to the appropriate people within Lubrizol. He then forwarded the responses back to me. To my surprise, some of the younger guys thought rings not seating during break-in was an urban legend.

If you talk with some veteran mechanics, you learn the problem can be very real. What has changed is machining. Sophisticated machining can make such a straight and uniform surface that break-in is not much of an issue in new vehicles anymore.



On the other hand seating the rings can still be a problem in a rebuild. Not all machine shops have the new sophisticated equipment. Then there are shade tree mechanics that use a berry bush hone (some call it a rabbit turd hone) to prepare the cylinder. There is nothing necessarily wrong with older machining methods, but

(Continued on page 2)

(Continued from page 1)

seating the rings may be more of a challenge.

### HEAT AND LOAD

Engines that work hard seat their rings more readily than those that do not. We need some wear to take place during break-in for the parts to polish each other. Additional heat and load facilitate the process.

John Deere recommends, "the engine should be operated at heavy loads with minimal idling during the break-in period."

As a former John Deere Global Fleet Management Solutions Manager put it, "We have never seen a problem in a field tractor. If there has been a problem, it was always in a chore tractor." Typically implements are matched to the tractor such that the tractor operates at or near full load. This heavy field work seats the rings much more easily than light loads at low RPM.

An engine that works harder burns more fuel, which exposes the cylinder to more heat. Also the cylinder pressures are higher in a harder working engine, causing increased wear rates. Both conditions help seat the rings.

### OIL FORMULATION

It would be nice if there were an SAE paper describing break-in with similar oils, but varying components and viscosity. It does not exist.

The voices in my head tell me that friction modifiers increase the risk of an improper break-in. Friction modifiers are added to passenger car oils to improve fuel

## Breaking the Glaze

I have spoken with three very experienced mechanics (very experienced sounds nicer than old) who told me how to seat rings after a "glaze" sets up on the cylinder walls. Just sift a little Bon Ami into the intake air after the filter, continue running it for a few minutes, and then change oil. The abrasive cleaner scrubs the cylinder and seats the rings. I doubt they shared their method with their customers, but from their stand point, they had nothing to lose. If it did not work, they had to take the engine apart anyway. It should go without saying, we do not endorse this method of seating the rings.

Recent information from John Deere indicates that if an engine does not break in properly, their break-in oil can be used after the fact to help seat the rings and lower oil consumption. "If oil consumption is observed after the initial break-in period when using other oils..." (not John Deere Break-In Oil) "...installing John Deere Break-In Oil is highly recommended."



economy, and added to some diesel engine oils to reduce friction.

I offer as evidence, John Deere Break-In Oil. In comparing John Deere Break-In Oil with their regular oil, both have levels of detergent and anti-wear additives that you would expect from modern diesel engine oil. However, the regular is a 15W-40 containing moly, a friction modifier. The break-in oil is 10W-30 having no moly.

Some wear needs to occur during break-in to seat the rings. If friction modifiers prevent the parts from polishing each other, the engine is at greater risk of becoming an oil burner.

While we are on the topic of oil formulation during break-in, you have probably heard that synthetic oils cannot be used for break-in. Perhaps this was true of diester based oils in the early days of synthetic motor oils,

## Case Study

My father was Cen-Pe-Co's state representative for Iowa as I was growing up. In an era when two-lane highways had to encompass the town square of every dot on the map, many weeks he would be gone before I woke up Monday morning and he would not be back until Thursday or Friday afternoon. When he bought an airplane, it made a big difference in my life, and I got to see him every evening when the weather was good.

After a few years, an annual inspection revealed it was time for an overhaul. After the rebuild, the last cylinder in the 4 cylinder engine was throwing oil. Oil consumption can be a big deal in a plane. After all, if the spark plugs foul, you cannot just pull over to the side of the road.

On his mechanic's recommendation, he planned a trip. Full throttle for take-off, and then he left the throttle against the wall the entire way. When he landed in Indiana, nearly four hours later, the fourth cylinder was no longer throwing oil. The additional heat and load had seated the rings.

(Continued on page 5)

(Continued from page 2)

but there is no reason to believe that break-in oil cannot be made with a synthetic hydrocarbon base. In fact, synthetic break-in oils are available, and some new cars use synthetic oil for the factory fill.

### RECOMMENDATIONS

Cen-Pe-Co S-3 oils and Cen Pe Co Super Racing Oils do not contain the types of friction modifiers that interfere with seating the rings, and they have plenty of anti-wear additives for flat tappet cams within their intended engine groups. Our HPA Racing Oils and Extreme Duty Oils have types of friction modifiers that may interfere. Of course, our PV Synthetic Blend and Synthetic passenger car oils have friction modifiers and comply with passenger car anti-wear limits, making them unsuitable for break-in.

So, let us take what we know about machining, heat and load, and oil formulation and apply it.

### Racing and Pulling Engines

Dedicated racing and pulling engines are put under tremendous load and generate plenty of heat for break-in. They will seat the rings no matter what oil is used. Cen-Pe-Co Super Racing Oils and HPA Racing Oils are obvious choices.



### Hot Rods

The worst case scenario for seating rings is a high performance build by a shade-tree mechanic for a street car. I like grass-roots enthusiasts and admire people who do their own work. Their engines can enjoy big gains in horsepower and often have excellent durability.

But if the cylinder surface is not state-of-the-art, it needs some wear to seat the rings. To compound the problem you usually cannot create much heat or load on street tires, whether you obey the speed limit or not.

My recommendation for these worst-case engines is some other brand of oil or break-in oil. When there is a good chance the engine will suck oil, I want to be outside the blast radius. Other brands of oil are better at allowing wear, which will help the engine break in. After oil consumption has stabilized, usually during the short first drain, then is the time to use Cen-Pe-Co oil to keep the wear rate as low as possible. If the engine consumes oil toward the end of the first drain, an additional drain of break-in oil should be used before changing to Cen-Pe-Co.

### Other Engines

For other engines, evaluate how the engine was rebuilt and how it will be used. The more sophisticated the cylinder machining and the harder the use, the more comfortable you should be in recommending Cen Pe Co S-3 oil for break-in.

Did they put new sleeves in the engine? What type of loads does the truck get and does it do a lot of idling? Is it a field tractor or chore tractor? Is the pickup used as a passenger vehicle or to tow trailers?

Do not be afraid to recommend our S-3 oil when the conditions are right. Conversely, do not hesitate to recommend the customer go elsewhere if the conditions make you nervous.

### WALKING AWAY

When the risk of rings not seating is high, the reward of one additional oil change is not enough. If the situation makes you uncomfortable in recommending Cen-Pe-Co oil, recommend something else for that first change after a rebuild.

The fact is that the engine needs some wear during break-in and Cen Pe Co oils are not good at allowing wear. There are plenty of cheap oils on the market that are much, much better at allowing wear.

However, for those engines that were properly rebuilt and work hard, Cen Pe Co S-3 and Super Racing Oils are good choices.

### References

“John Deere Break-In Engine Oil” AERA Technical Bulletin 2533, June 2010.

“How to Break-In Your Engine” General Aviation News 9/5/2012.

## Highlights From The OHIO FARM SCIENCE REVIEW



*Cen-Pe-Co Representatives working at the Ohio Farm Science Review: (From L to R) Dick Bowdle, OH pitches a prospective customer; Future Tractor Puller Jackson Lustik sits on his father Jordans' lap while loading the Silver Bullet tractor after being on display at the show; Dave Fitzpatrick, OH demonstrates the benefits of Columbia Sterling Fibre Coating to more prospective customers.*

*Directly above, (L to R) Representing Cen-Pe-Co are Milt Boerger, OH; Dick Bowdle, OH; Regional Representative Duane Tooman, OH; and Dave Fitzpatrick, OH.*



*The folks at Eagle Machinery & Supply, OH, a Cen-Pe-Co Lubricants Sales Distributor, devised this awesome looking water cart to be used on their tractor pulling track during the two tractor pulls that they organized this summer. What a great way to promote the Cen-Pe-Co Brand! Great job to our friends at Eagle Machinery & Supply.*