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cen·pe·co® LUBRICANTS

CENTRAL PETROLEUM COMPANY
Cleveland, OH Walcott, IA

CENTRAL NEWS©

Issue 848

SEASONS GREETINGS

Our 103rd year in business achieved another all-time national sales record. Led by a 15% gallonage increase in Multi-Purpose Hydraulic and Wet Brake Oil, both Lubricant and Fuel Additive sales continued their upward trend. At last year's National Sales Convention at Saint Simons Island, Georgia, Blaine featured and pushed Multi-Purpose at the technical meeting and our sales force listened! Merry Christmas Cen-Pe-Co!

Led by Gary Knecht's record 31st yearly sales gain in a row, most other salesmen also had a sales increases. For the first time Dave Stevenson's New York and New England Region totals 5 of our top 10 yearly sales producers, and Paul Obert's-Bob Nagle's and Larry Bayer's Illinois Regions led the state of Illinois to another 1st place finish.

This years top 5 salesmen reshuffled the deck so to speak with 1st place going again to Gary Knecht, 2nd place going to Phil McIntire, 3rd place Tom Burns, 4th place Herb Cox, and 5th place Dave Fitzpatrick. Congratulations All!

Our Quality products continue to shine and our customers continue to lead the way towards feeding the World. I would like to thank our salesforce, distributors, office and plant personnel, drivers and customers for their hard work and dedication, and wish everyone a Merry Christmas and Happy New Year.

Paul T. Webster III

SYNTHETIC VS PARAFFIN BASE

By Blaine Ballentine, Lubrication Engineer

In today's economy, many consumers want value more than ever. They are not just looking for the lowest price, but the best product for the money. They are willing to pay up for a better product.

That is one of the reasons that Cen-Pe-Co continues to grow. We also have customers looking at synthetic oils. They are willing to pay even more for a better product if they think it will provide greater benefits, such as extended drains or less wear.

Cen-Pe-Co offers both synthetic oils and paraffin base oils. This article discusses which provides more value in diesel engines.

An Engineer's Perspective

When you say the word "synthetic," some people sigh and get a warm fuzzy feeling. On the other hand, some people react as though it were a dirty word. We are looking for value, so we will try to set aside any emotional bias and just consider the facts.

Synthetic base oil is not magical—it is a material. Like all materials, it has its own set of strengths and weaknesses. It is not better or worse than paraffin base oil, just different.

We intend to look at those strengths and weaknesses and determine the applications where they create additional value compared to paraffin base oil.

Definition

We should probably start by defining the term "synthetic" as it applies to motor oil. PAOs (polyalphaolefins) are synthetic hydrocarbons built up in a reactor, which meet anyone's definition of synthetic. PAOs are the second most popular base oil used in synthetic oils.

The most popular synthetic base oil is severely refined petroleum oil. During processing, the wax molecules are not removed, but broken into branched chain paraffin molecules. Even though only a small portion of the oil undergoes a molecular change, the courts decided that this molecular change is a step in synthesis, and therefore, "synthetic."

The result of these severe refining techniques leaves us with a base oil that is so pure its characteristics (cold flow, oxidation stability, surface tension, solvency, lubricity, etc.) are closer to that of PAO than traditionally refined base oil.

We will lump these two types of synthetic base oil together, even though there are differences. Both are headed away from the properties of traditionally refined base oils in the same direction. The PAO just goes a little further down that path.

Strengths and Weaknesses

The two primary strengths of synthetic base oil are cold temperature flow and oxidation stability.

Put a sample of synthetic oil in the freezer next to a sample of mineral oil of similar viscosity and invert them after they cool. The synthetic oil is visibly thinner.

Superior oxidation stability does not necessarily mean it withstands higher temperatures, but that it withstands heat longer before it breaks down. In applications where oxidation is the limiting factor, synthetic oils have the advantage.

On the other hand, mineral oils provide superior rust inhibition and reduce wear, particularly scuffing wear.

The reason behind mineral oil's superior rust inhibition[1] can be easily observed. Compare samples of synthetic oil and mineral oil of similar viscosity for the film they leave on the container. One could argue that mineral oil leaves a thicker film because it is more viscous at room temperature. So, heat the samples and you will find that the mineral oil still leaves more film on surface.

Mineral oils have lower surface tension than synthetic oils[2]. It is like comparing soft water with hard water. The liquid with the higher surface tension tends to bead up and run off the surface. Rust inhibitors can be added to either type of base oil, but they will be more effective in the oil that stays on the surface.

Oil thickens radically under pressure. In fact, the oil in the high load zone of a heavily loaded bearing can very temporarily become a solid, the consistency of cheese[3]. Between heavily loaded gears the pressures can be extreme. The oil responds by becoming a solid that is hard enough that it actually deforms the surface of the metal[4].

Mineral oils have higher pressure-viscosity coefficients than synthetic oils[5], which means that as pressure increases, mineral oils increase in viscosity at a faster rate. So, we take a mineral oil and a synthetic oil of the same viscosity and apply load. As the load becomes severe, the mineral oil will build a thicker film, reducing wear.

Now that we have identified the major differences between synthetic oils and mineral oils, we can determine the conditions that make each the most appropriate.

Cold Temperature Flow

Synthetic oils are thinner than mineral oils at low temperatures. Engines need sufficient RPM to start, and synthetic oils allow the engine to crank faster in the cold for easier starting. They also circulate to the valve train and turbo much faster than mineral oils, reducing wear during warm up.

Diesel engines with unit injectors use the engine oil and hydraulic pressure to fire injectors. Many of those engines will not even start in extreme cold with ordinary 15W-40, but fire up right away with synthetic 5W-40.

Synthetic oils save energy. There is less parasitic drag during warm up because synthetic oils do not become as thick in the cold. That is fairly straight forward, but they can also save energy in ways that are not as obvious.

Because of their excellent low temperature flow properties, synthetic oil can often eliminate the need for a block heater, heating the building in which the vehicle is stored, injecting ether, or other starting aids. It not only saves diesel fuel during warm up, but it can also save other

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forms of energy wasted in making starting easier.

So, Cen-Pe-Co Extreme Duty Synthetic 5W-40 makes sense for diesel engines that start frequently in cold weather. It is also well suited to users that cannot wait for their vehicle to warm up. Some people seem to have their pickup in reverse and backing out before the pinion gear from the starter has disengaged from the flywheel. Extreme Duty Synthetic is well suited to this impatient group, particularly during winter months.

Start-Up

We have all heard many times that 80% of all engine wear occurs at start-up, but no one has offered any data to support that statistic. Sixty percent of all statistics are made up, including this one, and if we repeat it enough times, 90% of the people will believe it.

Yes, accelerated wear occurs at start-up as the bearings transition from boundary lubrication to hydrodynamic lubrication, but the amount is unknown and will vary with the engine and its duty cycle.

Although synthetic oils flow faster at start-up, they leave less film behind when the engine is shut down. Mineral oils leave more film behind, possibly reducing wear at start-up.

Before you mark a plus for mineral oil under the column for start-up, consider the reason for the push to SAE 15W-40 from SAE 30 in the mid '70s. Truck drivers that were patient and let their engines warm up before starting out did not have a problem. But drivers that started up and took off before oil had completely circulated through the engine, which could take five minutes on a cold day with SAE 30, had a high incidence of turbo failures. The oil that was thinner at start-up saved the manufacturers from warranty claims. Quicker circulation at start-up is definitely a benefit, and here synthetic oils are superior.

So which is better at start-up, synthetic or mineral oil? They have different properties, so the better choice depends on the operator.

At one extreme, we see people start their engine and then wait inside until all the frost has melted off their windows and the cab is nice and warm. These engines are likely to experience less wear with Cen-Pe-Co Extreme Duty or S-3 15W-40 because of the thicker oil film remaining on the parts after the engine is shut down.

At the other extreme, we see people that are accelerating away as soon as the engine fires. The oil is really thick, circulating slowly, and bypasses the filter as they power toward their destination. This group is better off using Cen-Pe-Co Extreme Duty Synthetic that quickly makes it through the valve train and turbo after start-up.

ALS Tribology

Diesel Engine

Unit No. 1369

Unit:
Make Cummins
Model ISX
Serial No.

Site

Compartment:
Name Diesel Engine
Make Cummins
Model ISX-475
Serial No.
Capacity: 11.0 gal

Customer:

DIAGNOSIS

All wear rates normal. Abrasive and other contaminant levels are acceptable. Viscosity within specified operating range.

Action: As oil and filter(s) already changed, resample next recommended service interval to further monitor.

ANALYST: Eric.Dunlap

Normal

LEGEND: Severe, Abnormal, Caution, Normal

DATE SAMPLED			
DATE RECEIVED			
DATE REPORTED			
LAB NO.			
SIF NO.			
TIME ON UNIT	Mi	1231494	1181546
TIME ON OIL	Mi	102923	52975
OIL BRAND		Cen-Pe-Co	Cen-Pe-Co
OIL TYPE		S-3	S-3
OIL GRADE		SAE 15W40	SAE 15W40
OIL ADDED	gal		
FILTER	Mi	49948	
OIL CHANGED		Changed	Not Changed
WO NUMBER			
Metals (ppm)			
Iron (Fe)		9	12
Chromium (Cr)		<1	<1
Lead (Pb)		6	7
Copper (Cu)		3	2
Tin (Sn)		<1	<1
Aluminium (Al)		2	5
Nickel (Ni)		<1	<1
Silver (Ag)		<1	1
Titanium (Ti)		<1	<1
Vanadium (V)		<1	<1
Contaminants (ppm)			
Silicon (Si)		5	7
Sodium (Na)		4	6
Potassium (K)		<5	<5
Water (%)		<0.05	<0.05
Coolant		No	No
Additives (ppm)			
Magnesium (Mg)		533	444
Calcium (Ca)		3170	3895
Barium (Ba)		89	121
Phosphorus (P)		1221	1390
Zinc (Zn)		1456	1641
Molybdenum (Mo)		11	<1
Boron (B)		10	<5
Physical Tests			
Viscosity (cSt 100C)		14.4	14.9
Fuel (%)		<1	<1
Soot (%) Infrared		0.3	0.2
Physical / Chemical			
Acid Number (mgKOH/g)		3.89	3.74
Base Number (mgKOH/g)		8.1	7.7

Oxidation Stability

When oxidation is the limiting factor, synthetic oil allows longer drain intervals. However, we are focused on diesel engines and oxidation is rarely the limiting factor for diesel engines using Cen-Pe-Co oil.

Some of our trucking customers have run their oil too long. When they did, analysis indicated that soot had overwhelmed the dispersants, and the oil could not hold any more soot. Analysis showed the soot level was high and viscosity above the SAE 40 range, but the TAN and/or oxidation, nitration, and sulfation numbers were normal.

Oxidation may be a factor for other mineral-based oils, but our pure paraffin base oil is perhaps the most oxidatively stable traditionally refined mineral oil available. In the absence of overheating, soot loading is the limiting factor for drain intervals with our oil in diesel engines, in spite of the additional dispersant packed into it.

When soot loading is the weak link, strengthening the oxidation link does not result in a stronger chain. Synthetic base oil will not provide additional extended drain protection in diesel engines compared to our paraffin base oils.

It is surprising just how long our paraffin base oils can hold up under the right conditions. Please look at the oil analysis accompanying this article. We spoke with the customer about how he achieved such an extraordinarily

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long drain interval, over 100,000 miles, on our S-3 15W-40.

First is his operation. He hauls from Illinois to California every week, so practically all interstate highway miles. He made some modifications, which greatly reduced the amount of soot blown into the oil. Then he added a bypass filter which removes particles and agglomerated soot down to two microns in diameter.

Of course, the long drain would not be impressive if oil consumption was high. However, he said he only added a gallon or two of make-up oil during the entire interval.

So this is a very special situation taking soot out of the equation with modified equipment, which permits extremely extended drain intervals. The point is that nature's best mineral oil can withstand diesel engine temperatures for an extremely long time, calling into question the benefit of a more oxidatively stable base oil.

In most diesel engines, Cen-Pe-Co Extreme Duty or S-3 Oil should provide equivalent long drain protection to Cen-Pe-Co Extreme Duty Synthetic.

Rust Inhibition

We put rust inhibitors in mineral oil and synthetic oil. They are more effective in mineral oil because mineral oil is better at wetting out the surface.

This ability to keep rust inhibitors on the surface gives mineral oils the advantage over synthetic oils in seasonal equipment. A great example is the farm combine that needs to resist storage rust for 10 months out of the year.

Rust inhibition is not much of a concern in a diesel pickup that is used every day and garaged every night. In this application, Cen-Pe-Co Extreme Duty Synthetic oil is certainly adequate in stopping rust.

For engines that are used infrequently, particularly if they are stored outdoors during the winter months, a fresh change with Cen-Pe-Co Extreme Duty or S-3 Oil will provide superior protection from rust.

Wear

When put under pressure, mineral oils build more viscosity than synthetic oils, providing a thicker oil film. It has an advantage in applications where pressures are severe, and the higher the pressure, the bigger the advantage.

Since pressure is the criterion, gearboxes and heavily loaded roller bearings make mineral oils an easy choice for reducing wear. Bearing load increases with RPM, so racing engines benefit from the superior film build of mineral oils, such as Cen-Pe-Co Racing Oil.

In lightly loaded industrial plain bearings or bearings in engines that run with light loads at low RPM, there is not enough pressure to build viscosity significantly, so there is little difference in film thickness between synthetic oil and mineral oil.

Diesel engines operating under heavy loads generate significant pressure in their bearings. When pressure peaks in the high load zone of the bearings, the higher pressure-viscosity coefficient of mineral oils builds a thicker film than synthetic oils to reduce wear.

There is little difference in mechanical wear performance between Cen-Pe-Co Extreme Duty Synthetic, regular Extreme Duty, and S-3 oils in diesel pickups used as passenger vehicles and other low load applications. Although Cen-Pe-Co Extreme Duty Synthetic is adequate in heavily loaded applications, such as tanker trucks and field tractors, these conditions favor Cen-Pe-Co Extreme Duty or S-3 Oil for wear protection.

Match Maker

This discussion should make it evident that synthetic oils and mineral oils are different. The better choice depends on the application. Evaluate the relative strengths and weaknesses of these oil types, and then match the better set of performances to the application. Whether the application favors synthetic oil or paraffin base oil, Cen-Pe-Co delivers value.

1. "Synthetic Hydraulic Fluids for High Performance Applications" Wilfried Bartz, Lubrication Engineering, Society of Tribologists and Lubrication Engineers, 10/2000 p44
2. "The Surface Tension Test - Is it Worth Resurrecting?" Practicing Oil Analysis, Noria, 9/2002
3. "Basics of Lubrication" Society of Tribologists and Lubrication Engineers, http://www.stle.org/resources/lubelearn/lubrication/#elasto
4. "Lubrication" Wikipedia, http://en.wikipedia.org/wiki/Lubrication
5. "Effect of Lubrication on Gear Surface Distress" American Gear Manufacturers Association Information Sheet AGMA 925-A03

NEWS FLASH!!

For those of you faithful "The Bachelor" viewers. Here is an unknown tidbit: Chris Soules, an Iowa Farmer, the main character, in the upcoming series to start in January on ABC, is a Cen-Pe-Co customer! And yes, he did purchase some Columbia Paint, so look closely at the farm scenes as it may be showing some of our paint products.