Mitigating Supply Chain Risks

Divergent Metalworking Fluid Markets
Specifications Galore

Like their counterparts in North America and Japan, automakers in Europe have long cooperated to develop industry-wide performance standards for engine oils used in passenger cars and heavy-duty trucks. The European Automobile Manufacturers Association (known by its French acronym ACEA) has 14 automaker members and develops its own set of oil testing sequences that use bench and engine tests to set a base level of parameters for engine oil performance, from total base number to viscosity, ability to withstand high temperatures and tendency to form oil deposits.

To a greater extent than the North American and Japanese industries, however, ACEA members have also developed their own standards on top. These generally incorporate an ACEA sequence as a starting point and then add one or more additional tests to measure a particular area of performance required for their own vehicles. The approach has led to a proliferation of oil sequences in the market, according to Richard van de Bulk, Oronite’s OEM liaison for automotive engine oils in Europe, Africa and the Middle East.

“This is the universe we have now in Europe – more than 50 [original equipment manufacturer] specs,” van de Bulk told the ICIS Middle East.
Restricting SAPS posed a significant challenge for oil formulators because some of the chemicals covered by SAPS limits were effective and efficient lubricant additives. Automakers have boosted fuel economy partly by reducing friction, and engine oils have played their role as formulators have significantly lowered oil viscosity. They also cut down on the weight of components throughout all sections of vehicles, including engines, and redesigned engines to incorporate technologies such as direct injection to make them more efficient.

Engines Evolving
Collectively, these changes in engine design had a dramatic effect on engine oils. Smaller engines have less power, all other things being equal. To maintain drivability and performance, automakers therefore installed turbochargers, which previously had been used mostly in sporty vehicles but which now are built into more common cars. Maintaining or increasing power in smaller engines creates a tough environment for engine oils because it increases power density and raises operating temperatures. Those conditions cause oils to degrade sooner, to thicken faster and makes them more prone to form deposits. Of course, that means the engines need lubricants that will address these tendencies.

“It means that the lube must work in a highly loaded, hot-running engine,” van de Bulk said. “As a result, the oil needs higher amounts of anti-oxidants and other additives to control oxidation, to ensure cleanliness and [to combat] viscosity increase over the life-time of the drain interval.”

Van de Bulk cited one example to illustrate what is happening in the industry. Ford’s 2016 Focus Ecoboost is a down-sized three-cylinder, 1-liter engine, but it has a turbocharger and direct injection. He compared it with the Porsche 911 Turbo, which also has a turbocharger in its 3.8 liter, six-cylinder, direct-injected engine. Even though the Ecoboost has far less power than the Porsche – just 92 kilowatts compared with 383 kW – its power density is comparable, at 92 kW per liter versus 101 kW per liter for the Porsche.
The Ecoboost cannot touch the Porsche in terms of acceleration or speed; it takes 11 seconds to reach 100 km per hour and tops out at 195 km/h, while the Porsche takes just 3.4 seconds to reach 100 and can travel at 315 km/h. But bearing in mind the aim of the engine developments is fuel economy and emissions reduction, the Ecoboost can travel 21 km on a liter of gasoline and emits just 108 g/km of carbon dioxide while the Porsche gets 10.3 km/l and emits 227 g/km of carbon dioxide.

As can be seen, the two cars have similar power densities and both have turbochargers and direct injection units. Consequently, their lubrication needs are similarly challenging.

“If you have a Porsche 911, I’m sure you would make sure a high-quality oil was used to protect the engine of your high-performance car,” van den Bulk said. “But even in your standard family car, now you have very sophisticated engine technology, and that’s why the OEMs are asking the operators to protect these vehicles with high-quality oils.”

It is up to automakers – aided by the oil and additive industries – to define the lubrication needs of those engines. OEMs have staff members responsible for this, van den Bulk said, and because of the rapid pace at which engine technologies are developing, they lack confidence that ACEA sequences can fully meet the needs of newest vehicles.

Van den Bulk cited BMW’s development of the BMW N20, a downsized engine that replaced the BMW N52 in some vehicles. The N52 was a six-cylinder, 3.0-liter engine with port fuel injection and no turbocharger. The N20 is a four-cylinder, 2.0-liter engine with direct injection and a turbocharger. The N52 generated 190 kW of power, or 63 kW/l, whereas the N20 generates 180 kW, or 90 kW/l.

BMW had used the N52 in an engine test for durability, so it developed a new test using the N20. Van den Bulk recounted how the company ran the new test using oils that had previously passed the N52 test and found that the oils did not perform as well on the new test. They generated markedly more deposits on the piston of the N20 and deposits formed on the N20’s turbocharger, too.

The results showed BMW that the new engine requires oils to have better oxidation stability and deposit control, he said. They also led the company to add the N20 durability test to all of its specifications for long-life engine oils to spur the industry to develop even higher quality oils.

**Oil Specs in the Middle East**

The proliferation of specifications creates challenges for lubricant suppliers because it means they must obtain a greater number of approvals if they want to appeal to a broad section of the engine oil market. It also makes it more difficult for vehicle owners to use the proper oils.

Automakers do have more latitude outside of Europe, in areas such as the Middle East. The main reason is that Middle East, and some other regions, lag behind the EU’s automobile emissions regulations, so vehicles there are not required to have advanced emissions control technologies such as particulate filters. This frees oil formulators to use additives that have been restricted in more developed markets, such as zinc dithiophosphate, which for decades has been effective as both an anti-wear agent and corrosion inhibitor. Detergent additives that face restrictions in Europe can also be used more freely in the Middle East.

That is fortunate, because the Middle East is in some ways a more challenging environment for engine oils because lower quality fuels are used in several of its markets.

“What remember, low-SAPS oils are mandatory only with after-treatment technologies,” van den Bulk said. “A lot of our customers outside Europe always ask us for additive packages for the latest oil specifications, which are the mid-SAPS ones,” he continued. “But the latest specs are not always the best fit. We try to explain that good old conventional oils, which in most cases are also updated regularly, are what OEMs would like to see used in those vehicles.”

European OEMs hope this makes it easier for operators in the Middle East to follow the oil recommendations for that region. Van den Bulk acknowledged, though, that there is still a need to educate the market about European specifications and about which ones apply to that region.