Railroad Engine Oil Adapts to a Low-Sulfur World

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Manufacturers and operators of diesel-powered locomotives around the world are working to meet increasingly stringent emission regulations and fuel standards. These efforts have led to significant modifications in engine design. In 2015, the introduction of Tier 4 locomotives and new engine technology in the United States represented a major change in engine severity. Exhaust after- treatments combined with tighter engine tolerances and reduced oil consumption increased the importance of engine oil performance and oil drain intervals with increased severity on parameters such as acid neutralization, base retention, wear and oxidation control as well as piston deposits and overall engine cleanliness.

Meanwhile, regulators around the globe have mandated reductions in sulfur levels in diesel railroad fuel – although the pace of reduction varies widely among different markets. In North America, parts of Africa, Europe, India and China, for example, sulfur content has dropped to ultra-low levels below 15 parts per million (ppm). Most nations have established regulations calling for sulfur levels of 50 ppm or less. Brazil is among the markets that still allow for between 10 and 500 ppm. However, there is little question that lower-sulfur diesel is the wave of the future. Even in emerging markets such as Kazakhstan and other East European countries the global railroad industry is under pressure to adapt.

The convergence of these trends were the drivers behind the development of the Locomotive Maintenance Officers Association (LMOA) Generation 7 railroad engine oil performance category. Launched in 2016 in the United States, Generation 7 railroad engine oil technology improves upon several performance attributes over previous generations and is optimized for low- sulfur fuel and modern engine severity. In North America, all Class 1 railroads have transitioned to Generation 7 multi-grade engine oil. Leading locomotive OEM service manuals have been updated and recommend the use of LMOA Generation 7 on a global basis to align with the consumption of low sulfur diesel (≤ 500 ppm) and enhance used oil condition-based monitoring protocols.

Additives Make the Difference

Chevron Oronite, a global supplier of engine oil additive technology to lubricant producers, has been active in LMOA Generation 7 railroad engine oils since the category's inception. Oronite's OLOA® 42015 additive package was designed to meet or exceed LMOA's Gen 7 performance specification and has a finished oil BN of 11 (nominal). This product includes a complex detergent system optimized for base

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retention along with strong and weak acid neutralization. It also features excellent oxidation and wear inhibitor chemistry, which is zinc and phosphorus free and helps with high temperature oxidation and deposit control.

OLOA® 42015 underwent extensive field testing to gain approval from leading global railroad engine OEMs, including Wabtec and Progress Rail. Research and testing results have been borne out through real-world experience: Oils formulated with OLOA® 42015 have proven effective in more than twelve years of freight and passenger locomotive revenue service over millions of megawatt hours globally. While this product was intended to target Tier 4 locomotive emission, fuel and performance demands, it has been validated for backward compatibility with older, legacy locomotives to successfully meet the needs of locomotive fleets around the world. This has allowed international railroads to confidently transition from older engine oil technology to Gen 7 technology with little to no additional testing. While single grade (40 weight) engine oils are still in use, a majority of end users see the value in multi-grade 20W-40 Gen 7 engine oil for their mixed fleet of Wabtec and Progress Rail locomotives and have already made the transition.

With the drive toward low-sulfur railroad fuels and more efficient engine technology, demand for Generation 7 oils will continue to increase. To ensure security of supply and to foster global transitions, Chevron Oronite has expanded the number of manufacturing facilities globally for blending this additive package as well as streamlined business plans to ensure cost effective supply.

Exploring Renewable and Other Lower Carbon Intensity Fuels

As the world works to achieve its energy and environmental goals, railroad operators in the United States, Brazil, Indonesia, India and elsewhere have been exploring renewable alternatives to petroleum-based diesel. Some countries, such as Indonesia, have mandated blends of 30% or more biodiesel content in diesel fuels to reduce dependence on petroleum imports. Brazil allows for 14% and have plans to achieve 25% of biodiesel. While soy oil is the primary source of biodiesel in Brazil, fuel producers around the world are working with a wide diversity of feedstocks, from palm oil in Asia to corn oil, tallow fat and even recycled cooking oil in the United States. Chevron Oronite along with Chevron Renewable Energy Group (CREG) are working with Railroad OEMs and end users to validate the effectiveness of Generation 7 railroad oils in biodiesel and renewable diesel (hydrotreated vegetable oil) applications. Other future fuels on the horizon include ethanol, hydrogen, and ammonia, and Chevron Oronite is leading and supporting research and development of next generation engine oils that will work with these fuels.

Diverse raw materials used to make biodiesel at CREG

Lower-sulfur diesel fuels and advanced engine technology are quickly becoming the standard globally as the world progresses toward a lower carbon future. Now is the time for railroad operators to re-evaluate their lubrication practices, implement the benefits of Multi-Grade LMOA Generation 7 engine oil and start planning their long-term fuel strategy.

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