

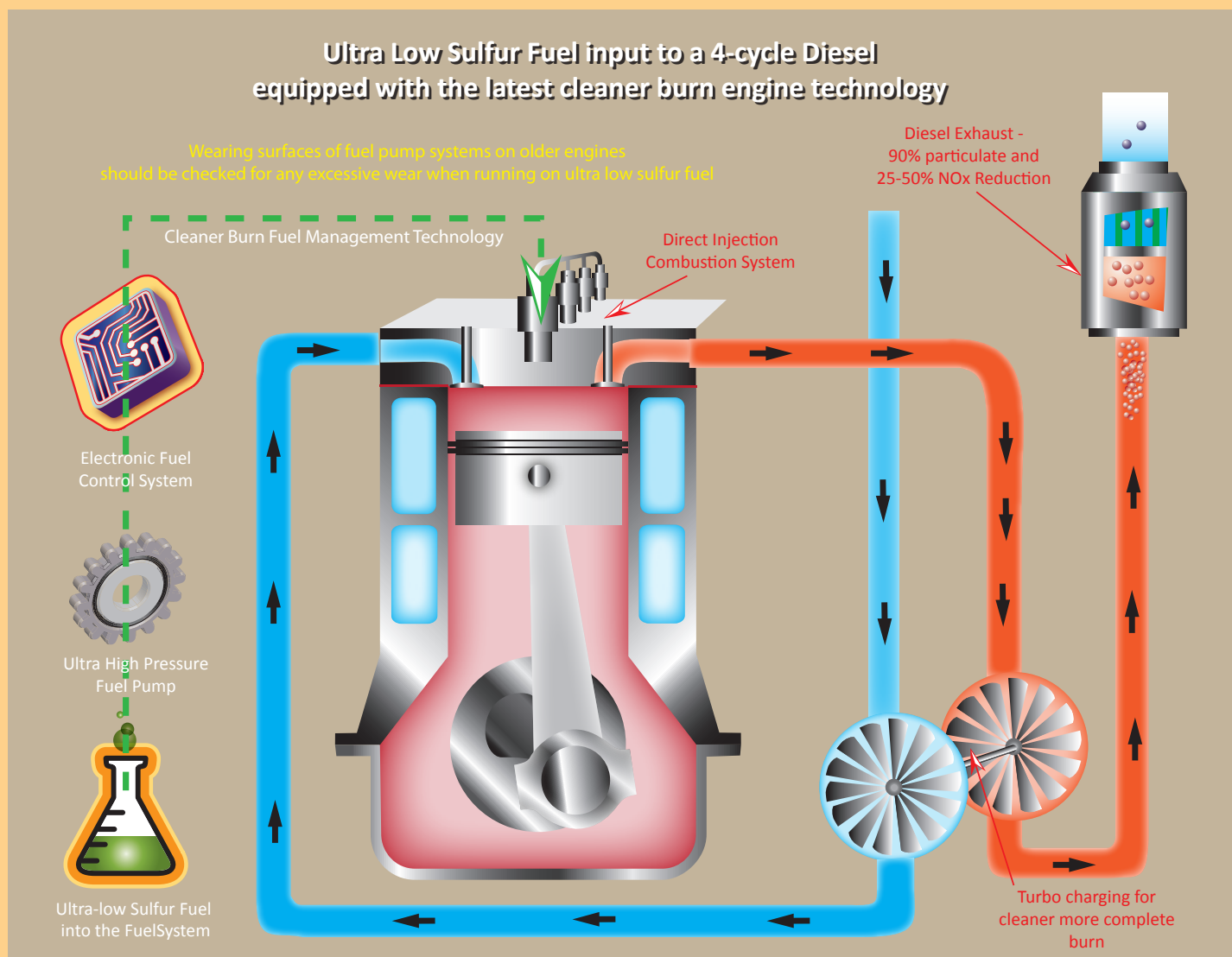
LOW SULFUR FUEL and the EFFECT on OLDER DIESEL ENGINE MODELS

Information Sheet # 26

Many developments in diesel engine design have been made to comply with current and planned EPA emission standards. The chart below shows diesel fuel is the first part of the combustion cycle. There is a limit to the emissions that can be achieved without ultra-low sulfur fuel.

This information sheet discusses low sulfur fuel and its lower lubrication properties on older engine models.

Some older engines benefitted from the lubricating properties of diesel fuel used prior to the introduction of lower sulfur diesel (See last three paragraphs over). The operator of a generator system using a diesel model built before the 500-ppm low sulfur 2007 fuel regulations should check with the engine manufacturer regarding any service or maintenance requirements when operating on low sulfur fuel. Further checking should be made on older engine models when 2010 diesel models will have to comply with 15-ppm Ultra Low Sulfur diesel. Trained service technicians can check for any signs of wear within the fuel pump resulting from the lower lubricating properties of low and future ultra low sulfur fuels. Over:



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The current generation of diesel engines that incorporate all the latest mechanical and electronic cleaner burn fuel injection technology such as high pressure pumps, solenoid operated injectors and common rail technology, do not rely on the lubricating properties of the fuel to the same degree as older style fuel injection systems.

A distributor/dealer's trained service technician during a planned service visit will check for any sign of wear on older style engines not equipped with the latest fuel injection technology.

Background to the US introduction of "Ultra Low" fuels

The Environmental Protection Agency has set ultra-low sulfur diesel as a new standard for the sulfur content in on-road diesel fuel sold in the United States since October 15, 2006, except in rural Alaska. California required it since September 1, 2006, and rural Alaska will switch all diesel to ULSD in 2010. This new regulation applies to all diesel fuel, diesel fuel additives and distillate fuels, such as kerosene, blended with diesel for on-road use. However, it does not yet apply to railroad locomotives, marine, or off-road uses. By December 1, 2010, all highway diesel will be ULSD. Non-road diesel changed to 500-ppm sulfur in 2007, and will change to ULSD in 2010. Locomotive and marine diesel also changed to 500-ppm sulfur in 2007, and will switch to ULSD in 2012. There are exemptions for small refiners of non-road, locomotive and marine diesel fuel that allow for 500-ppm diesel to remain in the system until 2014. After December 1, 2014, all highway, non-road, locomotive and marine diesel produced and imported will be ULSD.

The EPA mandated the use of ULSD fuel and newer highway diesel fuel engines with advanced emission control systems in the model year 2007. These advanced emission control technologies will be required for marine diesel engines in 2014 and for locomotives in 2015.

The allowable sulfur content for ULSD (15 ppm) is much lower than the previous 500-ppm U.S. on-highway standard for low sulfur diesel, which reduces emissions of sulfur compounds blamed for acid rain and allows the use of advanced control systems that would otherwise be poisoned by these compounds. These systems can greatly reduce emissions of oxides of nitrogen and particulates.

Because this grade of fuel is comparable to European grades, engines will no longer have to be redesigned to cope with higher sulfur content and may use advanced emissions control systems. Thus the standard may increase the availability in the U.S. of diesel-fueled passenger cars. European diesels are much more popular with buyers than those available in the U.S.

Additionally, the EPA is assisting manufacturers with the transition to tougher emissions regulations by loosening requirements for model year 2007 to 2009 light duty diesel engines. As a result, Honda, Nissan, Subaru, Toyota, and others are expecting to produce diesel vehicles for the U.S. market to join those from Mercedes-Benz and Volkswagen.

According to EPA estimates, the new fuel standards will reduce nitrogen oxide emissions by 2.6 million tons each year and soot or particulate matter by 110,000 tons.

Beginning June 1st, 2006, U.S. refiners were required to produce 80% of their annual output as ULSD (15 ppm). Also, petroleum marketers and retailers were required to label diesel fuel, diesel fuel additives and kerosene pumps with EPA-authorized language disclosing fuel type and sulfur content. EPA-authorized language on product transfer documents and sulfur-content testing standards also was required to prevent misfueling, contamination by higher-sulfur fuels and liability issues. The EPA deadline for industry compliance to a 15 ppm sulfur content was originally set for July 15, 2006, for distribution terminals, and by September 1, 2006 for retail distributions. But on November 8, 2005 the deadline was extended by 45 days to September 1, 2006 for terminals and October 15, 2006 for retail. In California, the extension was not granted and followed the original schedule. As of December, 2006 the ULSD standard has been in effect according to the amended schedule, and compliance at retail locations was reported to be in place.

The process used to reduce the sulfur content also reduces the fuel's lubricating properties. Lubricity is a measure of the fuel's ability to lubricate and protect the various parts of the engine's fuel injection system from wear. The processing required to reduce sulfur to 15 ppm also removes naturally-occurring lubricity agents in diesel fuel. To manage this change, ASTM International (formerly the American Society for Testing and Materials) adopted the lubricity specification defined in ASTM D975 for all diesel fuels and this standard went into effect January 1, 2005.

The refining process that removes the sulfur also reduces the aromatic content and density of the fuel, resulting in an approximately 1% decrease in energy content. This decrease in energy content may result in reduced peak power and fuel economy. The reduction is only slight and will likely go unnoticed.

ULSD will run in any engine designed for the ASTM D-975 diesel fuels.



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