



Technical Bulletin

Fuel Leaks From Seals of Vehicles Using Ultra Low Sulfur Diesel

Chevron Products Company

Summary

Some vehicle owners, who recently began using the new EPA regulated ultra low sulfur (S15) diesel fuel, report that their vehicles have developed fuel leaks. Similar occurrences were reported in the early 1990's when low sulfur fuel (S500) was introduced. The leaks in the 1990's occurred at points where elastomers (O-rings) are used to seal joints in the fuel system. During the 1993-94 period, the most common occurrences were injector fuel pump leaks.

This problem is not exclusive to one engine type, one fuel type, or one geographic region. It can affect some engines that are older than ten years, but some newer ones have experienced the problem as well.

The reoccurrence of these fuel leaks could become widespread geographically when the majority of fuel supplies are switched to S15. However, it is anticipated that only a very small fraction of the vehicles may be affected.

Of course it can be serious for owners whose vehicles are affected.

Chevron is working with diesel equipment manufacturers and providing technical support to fleets. The evidence to date suggests the problem is linked to a change in the aromatics content of the S15 ultra low sulfur diesel fuel, to seal material and age of the material.

Discussion

In October 1993, the 1990 Clean Air Act Amendments required that diesel fuel for "on highway" vehicles contain no more than 0.05 percent sulfur by weight. Before this, diesel fuel typically contained 0.2 to 0.4 percent sulfur by weight. Reports of fuel system seal leaks surfaced shortly after the introduction of the then new fuel designated as S500. Affected components were mostly fuel pump and injectors.

Starting June 2006, refineries will be required to produce diesel fuel with a

much lower sulfur level (15 ppm) than was contained in S500 (500 ppm). The new fuel is commonly known as ultra low sulfur fuel designated as S15 by the ASTM standard D 975. As noted earlier in some areas where this new S15 fuel has been introduced ahead of schedule, some occurrences of similar fuel leaks have been reported.

Should further elastomer failures occur, they are expected to be sporadic. Seals in some vehicles may fail while similar seals in other vehicles using the same fuel may not. Past experience indicates that the common denominator is expected to be nitrile rubber (Buna N) seals that have seen long service at high temperatures. High temperatures have a tendency to accelerate seal aging. The reduction in sulfur content is not responsible for the problem.

Two explanations have been offered to explain the sudden occurrence of seal failures:

- Many of the new S15 fuels are expected to contain lower levels of aromatics. The change from a higher to a lower aromatics fuel can cause seals to shrink. Aged seals, which do not have the elasticity to adapt to this change, appear to fail sooner.
- Some of the new S15 fuels are expected to be more susceptible to oxidation. The resulting oxidation products (peroxides) could attack the seal material and cause it to prematurely age.

To date we have not seen evidence of peroxide formation, therefore, we believe that most cases are related

directly to the reduction in the aromatics content of the fuel. This reduction is a result of increased hydrotreating to reduce fuel's sulfur level to 15 ppm.

Fuel additives do not appear to be a solution, since they do not change the aromatics content of the fuel.

The seal failure is not related to fuel lubricity. Lubricity affects wear of metal parts. There is no relationship between the fuel lubricity level and the elastomer failure. Currently all fuels in the U.S. must meet a minimum lubricity level.

The elastomer failures in the 1990's were addressed by a California Governor's Task Force. A comprehensive report was issued in 1994 which includes more details about this subject. For an online copy go to: <ftp://ftp.arb.ca.gov/carbis/reports/l639.pdf>

Recommendation

If you have a diesel fuel system that is leaking, Chevron recommends that you contact your equipment manufacturer for advice on the choice of a replacement elastomer for the seals and future maintenance schedule. Newly replaced seals should not develop a leak.

If you have not experienced this problem, you still may wish to consult your equipment manufacturer about a maintenance schedule for your aged nitrile rubber (Buna N) seals and manufacturer's experience with lower aromatics diesel.