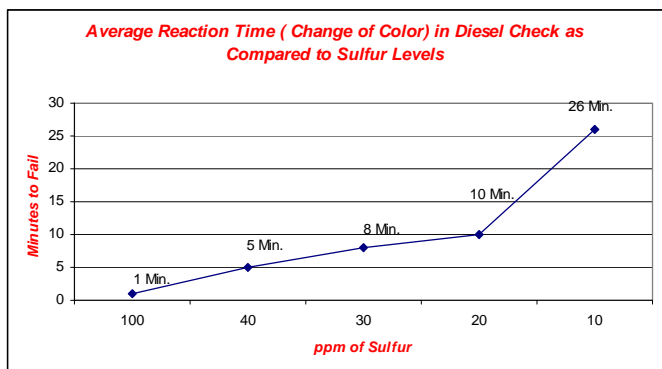


Question: How accurate is Diesel-Check?

Answer: Diesel-Check is a qualitative analysis. That is, we are looking for specific qualities inherent in Ultra Low Sulfur Diesel Fuel (ULSD). Therefore, precision and accuracy are not necessarily considered; rather, general levels of contamination can be obtained. Research has demonstrated that pure, uncontaminated ULSD will not react with the Diesel-Check test in the allotted amount of time. Fuels containing higher concentrations of sulfur or harmful levels of gasoline, hydroperoxides than ULSD products available today will react in the allotted time.

The graphics below show the relative accuracy and precision of samples run and rated against **time to color change** using the unaided eye. As can be seen the difference between 20 ppm sulfur and 10 ppm sulfur is dramatic. While 5 ppm takes well over an hour to change. Laboratory and field testing of good ULSD show the reactions to be consistent with these data. Good ULSD fuels do not change for an hour or more.



Sulfur ppm	Run #1	Run #2	Run #3	Run #4	Run #5	Average
5*	See Note					
10	21	32	26	22	29	26
20	11	10	11	10	10	10
30	9	7	7	8	7	8
40	7	4	5	4	4	5
100	1	1	1	1	1	1

Note: 5 ppm sulfur did not change color and was stopped at 90 minutes in all cases. 100 ppm changes immediately after shaking.

Question: What happens if after 15 minutes the test results are Okay (PASS) and later they are a FAIL?

Answer: The test is based on a chemical reaction. This reaction continues past 15 minutes. Even ULSD will eventually change color. We chose 15 minutes at room temperature based on the sample size, sulfur content, and the strength of the reagents (A and B). As can be seen in the above graphic it is possible to determine which ULSD fuel has more sulfur by waiting past 15 minutes. The sample that changes first will be the sample with more contamination.

Question: What happens if more than 4 drops of Solution B is added?

Answer: As of January 25, 2008 Solution "B" is no longer a liquid. It is now in the form a capsule. This capsule is simply dropped into the Solution "A" and fuel combination and then shaken. So there is no chance of adding more than the required amount.

If you are still using the liquid Solution "B" the answer to this question depends on the test results after 15 minutes. If more Solution B was added and the results are a FAIL, then the test results would have been a fail even if the 4 drops were added. If the results are a PASS then the test should be re-run. This is due to the fact we are measuring the rate of reaction with a known amount and concentration of Solution B. Replacement B capsules are available at no cost, just shipping. Ordering them will allow you to stop using the liquid.

Question: What happens if the test or fuel is much colder or hotter than room temperature?

Answer: Since the test uses a chemical reaction, temperature is considered a critical factor. The rate of chemical reaction speeds up as temperature increases and slows down as temperature decreases. This rate of reaction is generally accepted to be approximately doubled for every 18°F (10°C). So, if the temperature is substantially above room temperature and the sample is a PASS it would have also been a PASS at room temperature. If the test temperature is substantially below room temperature and the results are a PASS the test should be re-run at the appropriate temperature. The same logic, but in reverse, applies to FAILED samples.

Question: Will peroxide based Cetane Improvers affect the results?

Answer: Our research shows that Cetane Improvers do not influence the Diesel Check results. Peroxide based improvers (if there any commercially available) are made of diperoxides instead of hydroperoxides. Diperoxides are stable and only become reactive when the fuel is heated over the decomposition temperature (200F range). Testing concentrated amounts of di-tert-butylperoxide and phenyl peroxybenzoate showed no reaction in Diesel-Check after 15 minutes.

One reference to diperoxides is from United States Patent 5314511.

Abstract: *The present invention relates to a diesel fuel which contains a synergistic combination of an organic peroxidic additive such as ditertiary butyl peroxide in combination with a propylene or butylene glycol monoalkyl ether or polyol, the combination of additives providing for reduced fuel emissions and improved fuel economy.*

The levels of hydroperoxides we have found influencing the results are unsafe for use. They attack polymeric components/make varnish - similar to CARB fuels taken from truck engine fuel tanks in a research study conducted by the University of Dayton Research Institute in the 1990's.

Question: *We have a tank of ultra low diesel fuel (ULSD) we use on a regular basis to fuel smaller trucks. This tank showed PASS with Diesel Check last month but now it FAILS. We have not added any fuel in this time frame. What is the reason for the change?*

Answer: The most likely reason is the fuel in the tank is unstable and is forming hydroperoxides. Hydroperoxides react with reagent "B" and are harmful to fuel systems. We have seen this numerous times in the laboratory. A sample of good ULSD a fueling station pump PASSES, 30 days later it FAILS. We check the hydroperoxide levels and they are substantial higher then the month before causing a FAIL. Check with your fuel supplier about adding stability additives.

Hydroperoxide levels can be qualitatively checked in the field with the Herguth Technologies, Inc. hydroperoxide tester, or sample can be test quantitatively in the laboratory.

Question: *The Solution "B" has turned brown. What do I do?*

Answer: As of January 25, 2008 Solution "B" is no longer a liquid. It is now in the form a capsule. This capsule is simply dropped into the Solution "A" with fuel and shaken. The shelf life of the capsules is indefinite. It has been observed in the laboratory to last 15 years without changes.

However, if you are using the liquid Solution B simply contact the laboratory for replacement capsules . This will be done at no charge to you. Further to this issue, occasionally someone will accidentally use the same pipette to get Solution "B" that they used for the diesel fuel addition. This will cause the Solution "B" to degrade.

Question: *Does Diesel-Check work for Red Dye Diesel?*

Answer: Yes. When mixed, the dye stays in the bulk fuel phase and goes to the top of the vial. The lower portion where the comparison is made remains the same for yellow or red diesel fuel.

Question: *What is the shelf life of Diesel-Check?*

Answer: *The shelf life is indefinite. The old Solution "B" was estimated to be 7 months.*

Question: *What should we do when results are a fail rating?*

Answer: Clearly, this is not an issue in which Herguth Technologies, Inc. has any firm conviction. Many people use Diesel-Check for many different reasons. A fail rating tells you that the diesel fuel either has higher than acceptable sulfur levels than are found in Ultra Low Sulfur Diesel (ULSD), excessive amounts of harmful hydroperoxides, gasoline or chemicals not found in ULSD..

In either case, if you expected to find good, clean ULSD and did not, there is a problem. The precise amount of sulfur, gasoline or hydroperoxides can be measured by most competent fuel laboratories such as Herguth Laboratories, Inc. A qualitative analysis for hydroperoxides is available from Herguth Technologies. This kit checks for excessive hydroperoxides on site along with the Diesel-Check if there is a failure. This will help in further characterizing the failure. Contact Herguth for more information.

Question: *What are hydroperoxides and what do they do?*

Answer: The Engine Manufacturers Association describes hydroperoxides and the damage they can do as; *"The process of forming hydroperoxides involves fuel stability and a free radical chain that continues until the reactive molecular links or available oxygen are depleted. Peroxides (hydroperoxides) are reactive oxidizing agents formed during the first steps of fuel oxidation. At high concentrations, peroxides or the free radicals formed can damage or degrade certain plastics and elastomers, particularly at high temperatures. Subsequent steps in the oxidation process produce acids, gums, polymers, and other insolubles."*

Question: *What levels of Hydroperoxides are detected by Diesel-Check and what levels are considered to be harmful?*

Answer: Although the fact that hydroperoxides are harmful (and this is not disputed), there are no current specific requirements for the concentration of hydroperoxides in diesel fuel.

There are two American Society of Testing and Materials (ASTM) methods for measuring hydroperoxides in jet fuel. They are:

ASTM D6447-03 Standard Test Method for Hydroperoxide Number of Aviation Turbine Fuels by Voltammetric Analysis

ASTM D3703-99(2004) Standard Test Method for Peroxide Number of Aviation Turbine Fuels

Using either of these two methods, 4 Parts-Per-Million (ppm) is considered borderline for jet fuels.

Depending on the actual condition of the diesel fuel (fresh or old fuel, full of acid & varnish), levels of 20 to 40 ppm of hydroperoxides begin to influence Diesel-Check. Many fuels we have seen straight from the pump are in excess of 80 ppm. These have a dramatic impact on Diesel-Check and are, in our opinion, excessive and harmful.