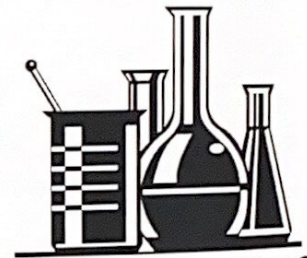


Issue 4
WATSON DIESEL INC.
Municipal News
Refining Fuel

In this issue of our news letter we are going to discuss the dreaded topic of winter time diesel fuel problems. Without boring you with a long chemistry lesson we will first discuss where diesel fuel comes from, what it used to be, what it is now and how it is not your father's diesel fuel. Winter time diesel engine operation has always been an ongoing fight, but over the past few years everyone has experienced a ratcheting up of problems associated with it.

First off, as we all know, diesel fuel is derived from crude oil pumped from deep in the ground. In its raw form it is a thick and almost tar substance unusable when in this raw form. A long time ago they found that they could refine this crude oil by a process known as refining. Crude oil is comprised of a set of atom chains. The length of these carbon atom chains can be broken down by the refining process to make various types of fuels. The refining process in a simplified explanation is where we heat the crude oil. As we heat the crude the different hydrocarbon chains that define the types of fuels all have a different boiling point. As the crude oil is heated they are able to "pull off" or separate the different fuels as they each reach their own boiling point. For example the methane fuel family (butane and propane) have a boiling point of less than 104 degrees, and are left with only about 1-4 carbon atoms. The gasoline boiling point is 400 degrees and has 5-12 carbon atoms, kerosene 615 degrees and 10-18 carbon atoms. Diesel fuel's boiling point at about 682 degrees has the most carbon atoms of the process. As you see the higher the temperature, the higher the viscosity of the product all the way up to tar. Now remember this as it will come in handy as we go along. The amount of these carbon atoms are what is responsible for the BTUs of a fuel, and how "dirty" the fuel is. As you may notice if you spill out some butane or propane it evaporates and hardly any residue is left behind. Gasoline leaves more of a residue, kerosene a little more. Diesel fuel with its high concentration of carbon atoms leaves the most residue (as you notice if you spill diesel on the floor it does not evaporate). So with this you will also understand that the methane family has the least amount of BTUs or energy, gasoline a little more, kerosene more yet and diesel fuel the most. As a matter of fact, gasoline has about 127,000 BTUs compared to diesel at over 150,000, thus giving the most power potential. Knowing that these fuels are linked to the amount of carbon atoms makes it easy to see how propane burns very clean compared to burning diesel fuel. The more carbon atoms, the more smoke and soot. Ok. So that's all for the chemistry lesson I promise.



So back before the advent of emission regulations we had a fuel that was pretty consistent and pretty reliable. But now with emission regulations (as if you don't have enough problems with your base engine headaches) we have a few curve balls to throw at you. The first is the introduction of ultra low sulfur fuel or ULSF. The reduction of sulfur in the fuel was necessary to allow the use of catalytic converters on your truck in an effort to reduce the amount of carbon monoxide that is emitted from the exhaust. ULSF by its nature has the ability to hold more dissolved or suspended water in it. Up to 2 times the amount of water. This dissolved water is a big problem in that it causes corrosion, rust, varnish and is a breeding ground for algae growth in your storage tank and in your truck's fuel tank. What this means is that as the fuel temperature drops the fuel is unable to hold the water in suspension and it starts to drop out of the fuel at a lot higher temperatures than non ULSF. The next problem we see with ULSF is what seems to be a lack of consistency in the product. Even though it is regulated to produce a product of a base standard these standards are kind of vague in some ways. ULSF also seems to be a less stable platform when it comes to the treatment of it. Standard "winterization" of diesel does not seem to be as consistent nor as reliable as the old non ULSF.

The industry has various tests for diesel fuel that include testing for pour point and cold filter plug point. Pour point or as we will call it and cold filter plug point or CFPP are the two standard tests to tell us how diesel will perform in cold weather. Cloud point is the temperature that diesel fuel is cooled to before wax crystals are actually visible in the fuel sample. CFPP is a test where as they pull 20cc of fuel through a 45 micron screen and cool the fuel until it can not pull the 20cc through. To get the pour

point lowered (so the wax formation temperature was lowered) used to be accomplished by cutting the fuel with kerosene. This was usually done at the refinery as their answer to "winterizing fuel". That is the reason that you get less performance and fuel mileage in the winter, and you pay more for the fuel (remember our chemistry lesson) - kerosene has less carbon atoms and thus less energy than straight diesel. Now that we are regulated to use only ULSF we can not "cut it" with ordinary kerosene but with ultra low sulfur kerosene. There are two problems with this. First off, the mixing of kerosene with ULSF does not yield the same results that non ULSF did. As a rule of thumb for every 10% of dilution with kerosene we would see a 5 degree reduction in pour point or wax formation. With ULSF the same 10% mix will result in 1-2 degrees of reduction only. When you add in the extra cost of refining the ULS kerosene along with its reduction in effectiveness you can see that the refineries don't have a lot of interest in doing much for winterization.

The next twist in the ULSF use in winter operation is a phenomenon know as "wax dropout". This occurs when the fuel is allowed to "cold soak" for a period of 48 - 72 hours. What happens is under extreme cold temperatures the wax crystals literally "fall out" all at once from the fuel. This "fallout" leaves the wax crystals completely separated from the fuel allowing it to form in the bottom of the tank and/or filters causing sudden fuel system starvation. And we are not finished yet.

Now enter our new high tech fuel injection systems. With the new high pressure fuel systems needed to meet the new emission regulations we are dealing with very close component clearances in pumps and injectors that need extra fine filtration of the fuel. We use to have secondary filters that used around a 10 micron element. Now we are down to 2 micron elements in some cases! Also in the old days depending on your engine of choice, the old injection systems returned fuel back to the fuel tank from the injection system at a high rate as a way to cool the injectors. Most of the new systems do not use this technology. So starting your engine and letting it warm up for an hour or so to "warm up the fuel tank" doesn't cut it anymore. So add the problems that we discussed about the new ULSF and its water and waxing problems and now try and draw that through a 2 micron filter and you can see why you are changing fuel filters at half the life of when you changed one in the "old days". Add to this the mandated use of Bio Fuels that actually has fatty material in it as a result of their refining process and it is just another curve ball to deal with.

We get calls all the time from customers that say they have this black crud in their filter when they change it. Once again this is the result of modern injection systems that operate under such high injection pressures that it heats the fuel to a point that it "refines" the fuel to a different value (remember the chemistry lesson I promised not to mention again) and actually changes the carbon atoms making it a different (and not a good) grade of product, kind of like tar!

The problem with diesel fuel is that you really have but one choice when you drive up to the fuel pump. Our brothers operating a gasoline powered unit can go to the fuel island and pick from up to 4 different grades of fuels, regular, premium and premium plus! But you only have one choice. And your one choice is not a very good one.

So until the government would come up with a new standard for diesel fuel (that will probably never happen) what are you to do? Well first off be proactive. If you wait until winter time to take action it is too late. I like to compare it to taking care of your swimming pool. As being a poor soul who owns a swimming pool it has come to my attention over the past few years that if you wait until the algae forms or your water turns green it's too late! You have to lead or guess at what your pool water needs before it needs it. In the same way you need to start your winterization program NOW. First and foremost if you have your own bulk fuel storage, check it for water and treat it for water now. And just because you have water don't call your supplier and complain. It probably wasn't sent to you with water in it. The water is more than likely a result of condensation. Remember ULSF can not hold the same amount of water as non ULSF.

Next talk to your fuel supplier and find out what program their vendor is using to treat the fuel. Then research the various fuel treatment manufacturers and find out what they offer and why you should use their product. There are good and bad out there. Next when you treat your fuel, don't just park the truck at night and dump a bottle of treatment in and expect miracles the next morning. Make sure the treatment is mixed with the fuel. Be proactive in changing your fuel filters. Yes it is expensive but so is setting along a cold lonely road in the middle of the night.

So get ready now. Winter is just around the corner. Talk to the suppliers that you purchase your fuel treatment from and talk to your fuel vendor and ask him what program he or his supplier has in place for winter fuel treatment. And remember, these problems that you are seeing with the "new diesel fuels" are not a product of your supplier but like the emission systems on your new diesel engine are a product of your government. So next time you have a fuel system freeze up, you're better off to call your Congressman than your fuel supplier. But better yet if you are having problems give us a call at Watson Diesel and we will help walk you through the maze of winter diesel operation problems. Your Congressman is probably in Florida on winter break anyway.