

## Timing the 6.9/7.3 IDI 201 or Using Bio-Diesel (B100) as a tuning aid

by Brian Jordan (The Grampulator)

Have you ever wondered if the timing on your diesel engine was set correctly? Does your fuel mileage or power seem low? Have you ever wanted to dynamically set the timing on your engine, but don't have a Dynamic Timing Meter, or didn't want to take it to the stealership to get it timed? Then listen up. Its not really as complicated as it seems and its even better than getting it done "on the rack". There is no substitute for optimally setting the timing for your vehicle.

The Haynes Techbook says "Diesel engines are very sensitive to slight changes in timing" this is very true! The diameter of the IP timing flange is 3 3/8". Multiplying by Pi to get the circumference, we get 10.602875207" dividing by 720 degrees (two crankshaft revolutions, we get 0.014726216" per degree. We'll call it .015 thousands of an inch per degree! So .030", about the thickness of a dime is about two degrees! Knowing this, we will proceed conservatively so we don't destroy the engine.

First, some info on bio-diesel:

1) Bio-diesel has a cetane number of about 50. North American petro-diesel has a cetane number of about 40. So what is cetane number, and why does this matter?

From Wikipedia: "Cetane number or CN is actually a measure of a fuel's ignition delay; the time period between the start of injection and the first identifiable pressure increase during combustion of the fuel. In a particular diesel engine, higher cetane fuels will have shorter ignition delay periods than lower cetane fuels." also "Generally, diesel engines run well with a CN from 40 to 55. Fuels with higher cetane number which have shorter ignition delays provide more time for the fuel combustion process to be completed. Hence, higher speed diesels operate more effectively with higher cetane number fuels."

Translation: bio-diesel requires LESS timing advance than petro-diesel. According to the Haynes Techbook about 2 degrees less timing. We'll take advantage of this in our quest for optimal timing.

2) Bio-diesel has better lubricity than petro-diesel 1% bio-diesel added to petro-diesel improves lubricity by 65% !! This is very important now since the introduction of ULSD (Ultra Low Sulfur Diesel). The sulfur in the petro-diesel supplied the lubricity for the IP (Injection Pump) and injectors. Unfortunately, it is not good for the environment. Anyone notice that IPs and injectors don't seem to last as long these days? Diesel Fuel additives for lubricity are essential these days! "Stanadyne recommends a 2% blend (of bio-diesel) for use with their equipment especially with the introduction of ultra low sulphur diesels."

3) Bio-diesel burns cleaner. "Scientific research confirms that bio-diesel exhaust has a less harmful impact on human health than petroleum diesel fuel. Bio-diesel emissions have decreased levels of polycyclic aromatic hydrocarbons (PAH) and nitrated PAH compounds that have been identified as potential cancer causing compounds. Test results indicate PAH compounds were reduced by 75 to 85 percent, with the exception of benzo(a)anthracene, which was reduced by roughly 50 percent. Targeted nPAH compounds were also reduced dramatically with bio-diesel fuel, with 2-nitrofluorene and 1-nitropyrene reduced by 90 percent, and the rest of the nPAH compounds reduced to only trace levels."

4) Bio-diesel will start to gel around the freezing point of water. I keep a jar of B100 outside where I can see if it is clear or cloudy.

5) The calorific value of bio-diesel is about 37.27 MJ/L. This is 9% lower than regular Number 2 petro-diesel

6) "Bio-diesel has different solvent properties than petro-diesel, and will degrade natural rubber gaskets and hoses in vehicles (mostly vehicles manufactured before 1992), although these tend to wear out naturally and most likely will have already been replaced with FKM (Viton), which is nonreactive to bio-diesel Bio-diesel has been known to break down deposits of residue in the fuel lines where petro-diesel has been used. As a result, fuel filters may become clogged with particulates if a quick transition to pure bio-diesel is made. Therefore, it is recommended to change the fuel filters on engines and heaters shortly after first switching to a bio-diesel blend."

Before we proceed, it is important that your engine is in good condition to start with. Power and fuel economy can be down for a number of reasons.

Are the fuel injectors good? Is the injection pump good? Is your compression good? I recently started this procedure on an old 6.9l. I did not know the condition of the injectors or IP or compression before I started. It seemed to run OK, but after the 3rd round of advancing it blew the head gasket between cylinders 5 and 7 and it ran like crap. It gave me the opportunity to spend some "quality time" with my engine, whereupon I found that only 2 of the fuel injectors were any good! Cylinder # 7 had the second best injector. I am truly amazed that the engine ran and made it home!

The point is if the injectors are bad, it won't be as sensitive to changes in timing. ie. timing that may be good for one cylinder may be worse for another.

See tech article on rebuilding injectors.

[http://www.blackwire.com/~bjordan/Tech/Rebuilding\\_IDI\\_injectors.pdf](http://www.blackwire.com/~bjordan/Tech/Rebuilding_IDI_injectors.pdf)

Ok, now lets get to it. This works well if you have dual tanks. You can fill one with B100 bio-diesel Since you already have accurate records of your fuel consumption, this should be a cinch. You have accurate records of your fuel consumption right? Ok, maybe we should start with a baseline. When you fill up, simply record the amount of fuel it took to fill up, and the current odometer reading. If we know how far we have gone, and divide that by the quantity of fuel we have put in, we will get the fuel consumption. This will be in MPG (Miles Per Gallon) or KPL (Kilometers Per Liter). Higher numbers are better. Don't get me started about liters/hundred kilometers! The more fill ups recorded, the more accurate the results will be.

This works best when the results can be duplicated. ie. running the same course, like commuting to work and back, or hauling a load up a hill.

Once we have a baseline, we can start. Once the engine is at operating temperature switch to the bio-diesel tank. Notice any difference? Does it idle higher? Lower? Does it rattle more? Less? Does it smoke less? Chances are it will smoke less. If it idles higher and rattles less, the engine timing probably needs to be advanced. Most factory timing settings are slightly retarded. Better to be safe than to warranty! But before advancing the timing, take it out on the road. Does it seem to run better or have more power? If so, chances are the timing can be advanced another 2 degrees. The results may be more subtle though. Hence the need to track the fuel consumption.

BTW, to advance the injector timing turn the IP counter clockwise. To retard the timing turn the IP clockwise. This is in relation to standing in front of the engine looking at the engine.

I recently acquired a 1992 F-250 with a 7.3L engine. After getting it running with the factory timing, the truck went on a 400 km journey burning about a tank and a half of B100 fuel. Not great mileage. It

seemed to run better with the B100 than with the B50 in the other tank, so the timing was advanced 2 degrees. The trip back took 50% less fuel! The B100 still seemed to run better than the B50, so the timing was advanced another 2 degrees. The increase in power was noticeable with the seat-of-the-pants meter. Both times, the increase in power was very noticeable when the timing was advanced. The downside of running the B100 is that it rattles like its going to fly apart when its cold. The IP advances the timing 6 degrees when cold. This is ok for petro-diesel, but because the bio-diesel burns faster, it does not require the extra advance.

You will reach a point in advancing the timing where there seems to be no noticeable difference between the bio-diesel and the petro-diesel. Advancing the timing 1 degree more should be optimal for petro-diesel Retarding it 1 degree should be optimal for B100.

If you find that the engine runs better with the petro-diesel than the bio-diesel, the timing may already be set optimally, or it may be too far advanced. You may want to retard the timing a degree or two and retest.

Optimal timing should give you best power and best fuel consumption. Happy motoring!

Full disclosure: I do not sell bio-diesel, but I do use it. My supplier albeit a DIYer makes a very good clean product. I am a minor (very minor) shareholder in a company called Biox. Stock symbol CA:BX Its a Canadian company that produces bio-diesel in Hamilton Ontario.