The Ecotec 2.0 liter turbocharged LNF engine has proven to be nothing short of amazing. In stock form, it produces 130 horsepower per liter of displacement, making it the highest output motor that GM has ever put into production. But it gets better! Add a handful of bolt-on modifications and you can add close to another 100 hp. You can also upgrade the turbocharger to a larger unit, and gain even more power! Perhaps even better, the LNF can also continue to average more than 30 miles per gallon even with 500 or more horsepower available when you hit the throttle. Part of the success is due to the direct injection fuel system utilized on the LNF engine. Direct injection, commonly referred to as DI, means that the fuel injectors actually spray directly into the combustion chamber, rather than into the intake ports as done in more common port-fuel injection. DI has the benefit of more accurate fuel placement and timing, which creates more horsepower even while using less fuel. However, it does bring about a new limitation. Rather than being able to spray fuel at any time, DI is limited to a window that is less than 40% of the engine cycle. The reason for this is simple. First, you can not start spraying fuel until the exhaust valve has closed. If the exhaust valve was still open, then fuel will spray right past the valve and burn in the manifold. While this strategy can be combined with retarded ignition timing to help spool a large turbo, it can not promote proper combustion when revving through the power band. Next, the DI injector must close with enough time for the fuel to travel where it needs to be before the spark plug fires. Spraying fuel too late in the cycle results in poor combustion and even misfires. Horsepower will typically decrease if the injector duty cycle is pushed past 40%, although this number varies based on the actual open and close angles utilized.

So what does this mean and is it important? Well, if you are running the stock turbo and filling your tank with gasoline, then you have nothing to worry about. The factory LNF fuel system can supply enough fuel for any amount of airflow that you will get from the stock turbo. When switching to E85, things change. Since the LNF burns approximately 30% more E85 compared to gas, the fuel system can now reach its limitations. The LNF uses two fuel pumps. The pump in the tank is of the common variety. It is an electric pump that supplies fuel with a regulated 60psi. This pump has very high flow for a factory pump. It can support up to 750(flywheel) horsepower on gasoline and 550 hp on E85. However, there is a second pump required in order to increase fuel pressure to more than 2200psi in order to spray directly into the combustion chamber even while the air pressure in the cylinder is already several hundred psi. This mechanical fuel pump is driven by the intake camshaft, which means that its output varies based on engine speed. While this is great when revving higher to make power with bigger turbos or aftermarket cams, it also means that at low engine speeds, available fuel volume is decreased. Anyone who runs E85 fuel with an aggressive tune to bring in boost at lower RPMs quickly finds out that the fuel system is not going to keep up. While the mechanical fuel pump is pumping slowly, but the turbo is already moving a lot of air, the pump simply does not move enough fuel. As a result, the fuel pressure will drop. While the ECM compensates by increasing the length of time that the injectors are open, this means that fuel is being delivered outside of the optimum injection window. Horsepower will then drop off or stay flat instead of climbing. Once the engine RPM is high enough to allow the mechanical pump to deliver enough fuel, then power will pick up again. Due to this problem, many have set up their ECM to bring in the boost slower in order to avoid the situation. However, this was no longer necessary after ZZP released our intake cam with larger fuel pump lobe. The larger pump lobe on this cam increases fuel pump piston travel by 27%, resulting in fuel flow increases of more than 20%. This has proven to adequately provide fuel on setups making more than 400 ft lbs of torque! When the factory cam is driving the pump, fuel system limits can be reached somewhere more in the area of 325-350 ft lbs of torque. Although this has become a popular mod for customers running E85 and/or larger than stock turbos, it is not for everyone. Others would prefer easier bolt-on modifications rather than swapping out the camshafts. Some people already have our cams, but still want more fuel system potential to run larger turbos pushing more than 450 ft lbs of torque when the boost hits. For these customers, we developed the new ZZP LNF5, which is a 5th injector system. The concept behind this kit is simple. When your mechanical fuel pump can no longer keep up with fuel system demands, you can divert some of the fuel from the DI fuel system and spray it directly into the intake manifold. Our 5th injector kit includes an adjustable controller that you mount inside the car. The controller allows you to set the boost level that you would like the 5th injector to begin spraying. It starts at a low duty cycle in order to keep the air fuel ratio from changing abruptly. The controller also includes a high boost setting which is the boost level at which your 5th injector will reach 100% duty cycle. The fuel injector mounts to the intake manifold in an existing hole, so the manifold does not have to be removed from the engine. In fact, the entire install can be completed in less than an hour. Simply unbolt the factory EVAP solenoid, mount the 5th injector kit, re-install the EVAP solenoid on the supplied bracket, and connect 4 wires. It is that simple.

While the LNF5 does not require tuning in some applications, it is usually beneficial to fine tune the ECM to match up better with the added fuel delivery. We can supply tech support for this type of tuning, and we also offer ECM files with these changes already in place. Feel free to contact us if you need help setting up your ECM file.