Chevrolet/GMC 6.6L Duramax LML Intercooler and Piping Kit

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Testing of the Chevrolet/GMC 6.6L Duramax LML Intercooler and Piping Kit

Figure 1: 2011 Chevy 2500HD used for R&D and testing

Test Vehicle

2011 Chevy 2500HD

Engine Modifications

None, fully factory

Objective

To make a direct-fit intercooler that is more durable and produces more power than the factory unit.

Testing conditions

All testing was performed in a climate-controlled garage that maintained an average temperature of 85°F and 35% humidity.

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Testing Equipment

To test the effects of different intercooler setups, a DynoJet dynamometer was used to measure the power output. PLX sensors and ScanXL Pro software were used to monitor and record inlet and outlet temperatures.

Goals and Metrics

Before development began on the LML Duramax intercooler and piping, goals and metrics were defined for the project. The first goal was to create an intercooler that fit directly into the truck without any cutting or permanent modifications needed. Second, the Mishimoto intercooler must provide an increased core volume to support larger turbochargers or increased boost pressure. The larger core should also show an increase in power and/or efficiency without a significant pressure drop when compared with the factory unit. The intercooler piping should show an increase in volume in order to support additional flow.

Research and Development

Intercooler

The first step in the R&D process was removal of the factory intercooler and radiator assembly to measure how much larger the Mishimoto intercooler could be made. With ample room in the front of the truck, the Mishimoto unit could be designed to be 73% thicker than factory and with a 101% increase in core volume. Figure 2 below shows the core volume of the Mishimoto intercooler compared to the factory unit.

Once the core dimensions were finalized, the next step was to choose bar and fin dimensions. Larger bars will allow for additional core volume and less pressure drop; however, this means the fins must be smaller, which reduces the core's heat transfer capabilities. Larger fins will allow for additional heat transfer, but if the bars are too small the core could be restrictive and cause a large pressure drop. Computational flow analysis gives an excellent starting point when optimizing an intercooler core design, but there's no match to real world experimentation and testing. This is why we chose to design and test two different cores to see how well the LML Duramax performed with each one.

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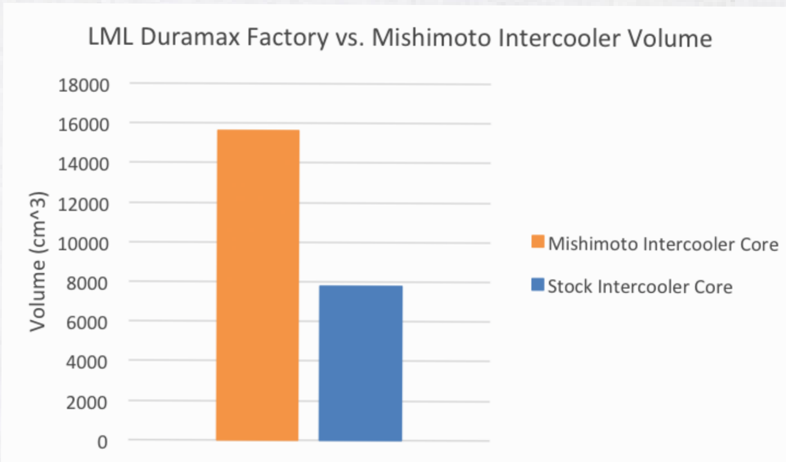

Figure 2: The Mishimoto intercooler core is 101% larger than the factory unit.

Intercooler Piping

The intercooler piping was designed to have minimal bends and as much volume as possible without significantly increasing turbo lag or pressure drop. The larger the intercooler piping, the more time required to fill it with pressurized air. On the other hand, if the piping is too small, then flow will become restricted and maximum power can't be achieved. The Mishimoto intercooler piping was designed to be slightly larger than factory to compliment larger turbo-chargers and increased pressure. Overall, the Mishimoto intercooler piping kit provides 42% more internal volume than the factory setup (as seen in Figure 3 below).

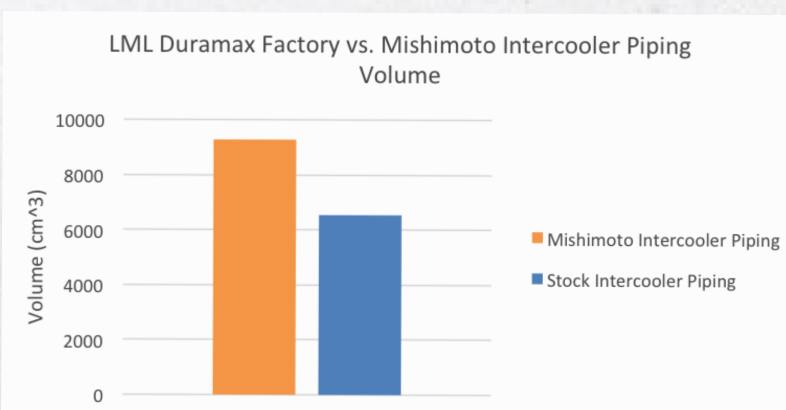

Figure 3: The Mishimoto intercooler piping provides 42% more internal volume than the factory piping.

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Experiment and Results

In order to verify that the Mishimoto intercooler flowed better than the factory unit, the LML Duramax was strapped to the dynamometer and a baseline pull was taken. The intercooler was then swapped with the first Mishimoto design and the truck was again tested on the dyno. The first core made slightly more power and torque than the factory setup while providing almost identical efficiencies and pressure drops. The second core was then bolted to the truck and it was again tested on the dyno. This core made slightly more power than the first core and gave an increase of 7 whp and 15 wtq over the completely factory setup. These results can be seen below in Figure 4.

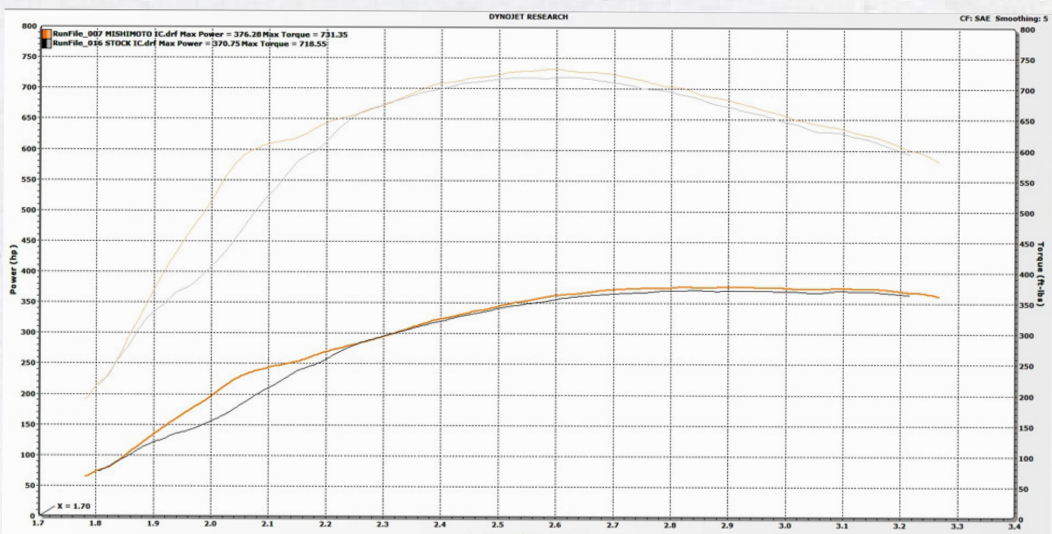

Figure 4: The Mishimoto intercooler provides max gains of 7 whp and 15 wtq over the factory setup.

It is important to note that the increase in power and torque before 2,200 rpm is likely due to the way the throttle was “rolled into” during the dyno pull. The max gains mentioned above were taken by analyzing the graph after 2,200 rpm.

From our testing it was clear that the second core performed slightly better than the first core and therefore was selected for the final design.

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Conclusion

The final Mishimoto intercooler design doubles the factory intercooler core volume without any significant decrease in pressure loss or efficiency. While the Mishimoto unit did give an increase of 15 wtq and 7 whp by simply bolting it on, larger power gains can be expected with added boost pressure and/or a larger turbocharger setup. When the boost is increased or a larger turbo is installed on the truck, the factory intercooler often begins to throttle the airflow because it isn't designed to handle the increased volume. The Mishimoto intercooler and piping were designed to handle the additional volumetric flow that a larger turbo will push out. Along with the capability of handling additional pressure and flow, the Mishimoto intercooler's cast aluminum end tanks eliminate any reliability issues that might occur with the factory unit (which has a plastic cold-side end tank).

Steve Wiley
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