MISHIMOTO

ENGINEERING REPORT

2013+ Dodge 6.7L Cummins Intercooler | SKU: MMINT-RAM-13

By Daniel Tafe, *Mishimoto Engineer*

REPORT AT A GLANCE

- **Goal:** Create a direct fit performance intercooler that outperforms the stock intercooler. The intercooler must also fit without trimming or modifying any other parts on the truck.
- **Results:** The Mishimoto Intercooler reduced outlet air temperatures by 10°F (5.6°C) compared to the stock intercooler while running on our dyno.
- **Conclusion:** The Mishimoto intercooler is a great upgrade for anyone looking to reduce intercooler air temperatures on their Dodge Cummins.

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DESIGN OBJECTIVES

The design requirements assigned to this project are as follows:

- Create an intercooler that performs better than the stock intercooler.
- Must be a direct fit with no cutting or permanent modification necessary.
- Mishimoto intercooler must not show a significant pressure loss when compared to the stock intercooler.

DESIGN AND FITMENTS

We began the R&D process by evaluating the stock Dodge Cummins Intercooler to find potential room for improvement. The stock intercooler is a 4.25" thick, 15-row tube-and-fin design. The Mishimoto intercooler was designed as a much larger 5" thick, 20-row bar-and-plate intercooler to increase the amount of cooling surface area and core volume. This design makes the Mishimoto intercooler 37.8% larger than the stock Dodge Cummins intercooler. Figure 1 and 2 show a comparison of internal core volumes and fin surface areas for the stock and Mishimoto intercoolers.

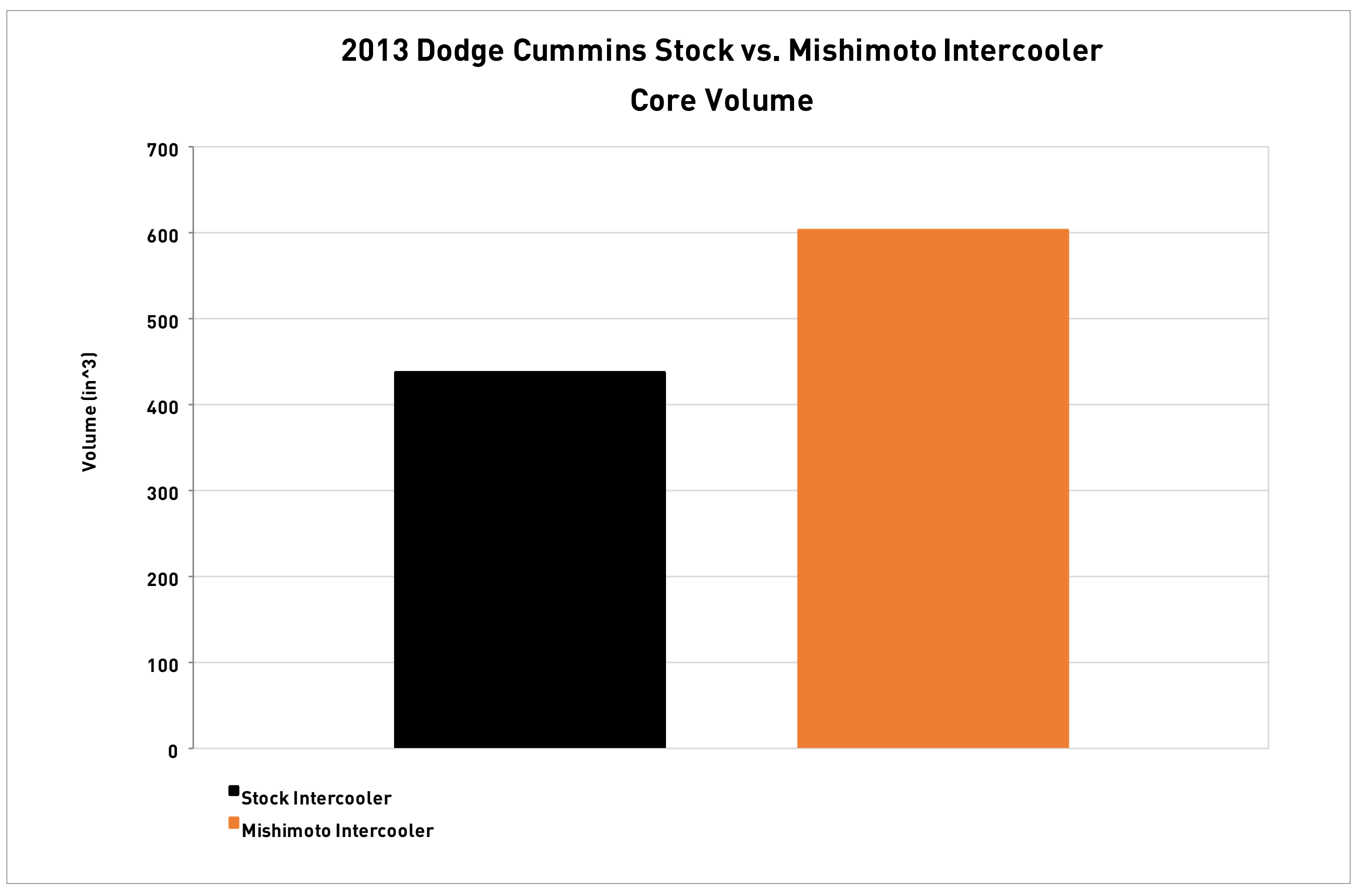

FIGURE 1: *The Mishimoto Intercooler has a 37.8% increase in overall core volume compared to the stock intercooler.*

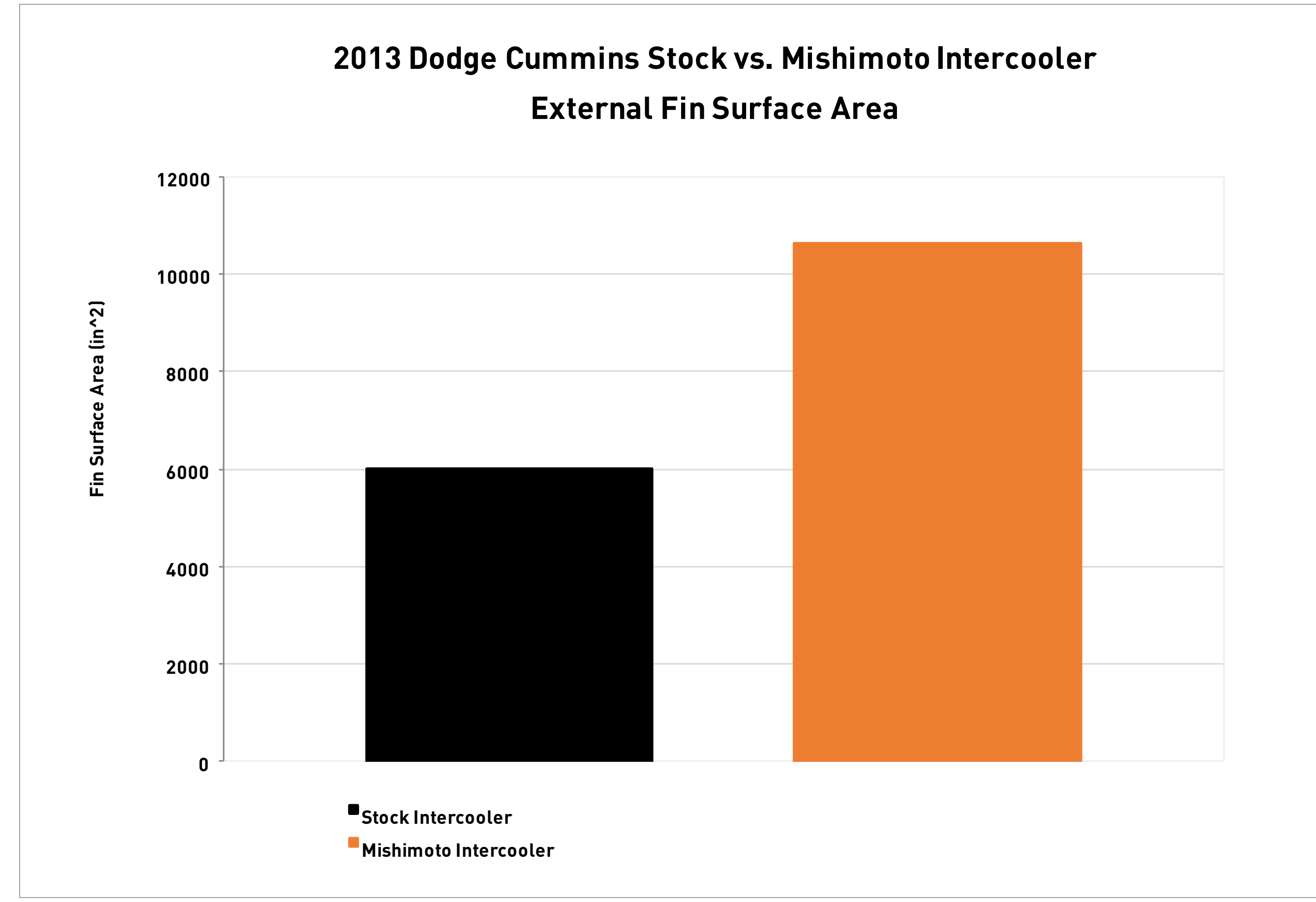

FIGURE 2: *The Mishimoto Intercooler piping showed top-end power and torque gains when compared to a fully stock car.*

APPARATUS

For hardware Mishimoto chose to use the AEM AQ-1 driven by the AQ-1 Data Acquisition System.

Air temperatures were taken with AEM intake air temperature sensors from the inlet and outlet of the stock and Mishimoto intercoolers. Boost pressure was also measured to ensure that no dramatic pressure drop occurs when installing the Mishimoto Intercooler. A baseline temperature and pressure were recorded before the Mishimoto Intercooler was installed. This allowed us to see how well the intercooler performed.

FIGURE 3: *AEM AQ-1 Data Logging System.*

PERFORMANCE TESTING

A 2014 Dodge Cummins was used to test each intercooler setup. The ambient temperature on the day of testing was approximately 60°F (15.6°C). To test the performance of the intercoolers, a DynoJet™ dynamometer was used to conduct consistent ramp tests.

The Dodge Cummins was warmed up by idling it on the dyno until the coolant temperature reached approximately 180°F (82.2°C). Once the truck was warmed up, dyno runs were conducted until multiple consistent runs were recorded. The truck was kept idling between runs to maintain a consistent engine coolant temp for every run. This test was then repeated with the Mishimoto Intercooler installed. See Figures 5–7.

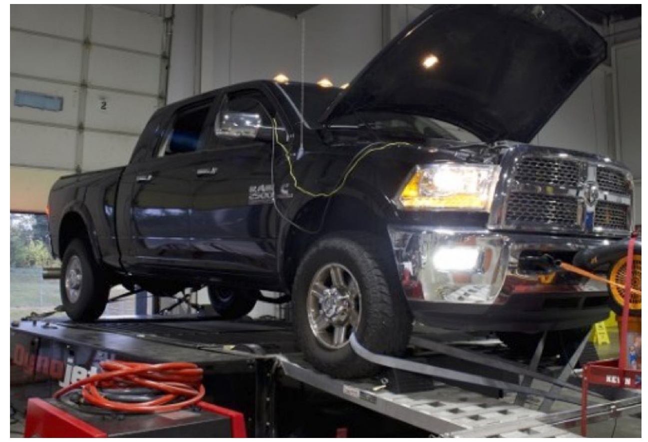

FIGURE 4: *A DynaJet™ dynamometer was used for vehicle testing.*

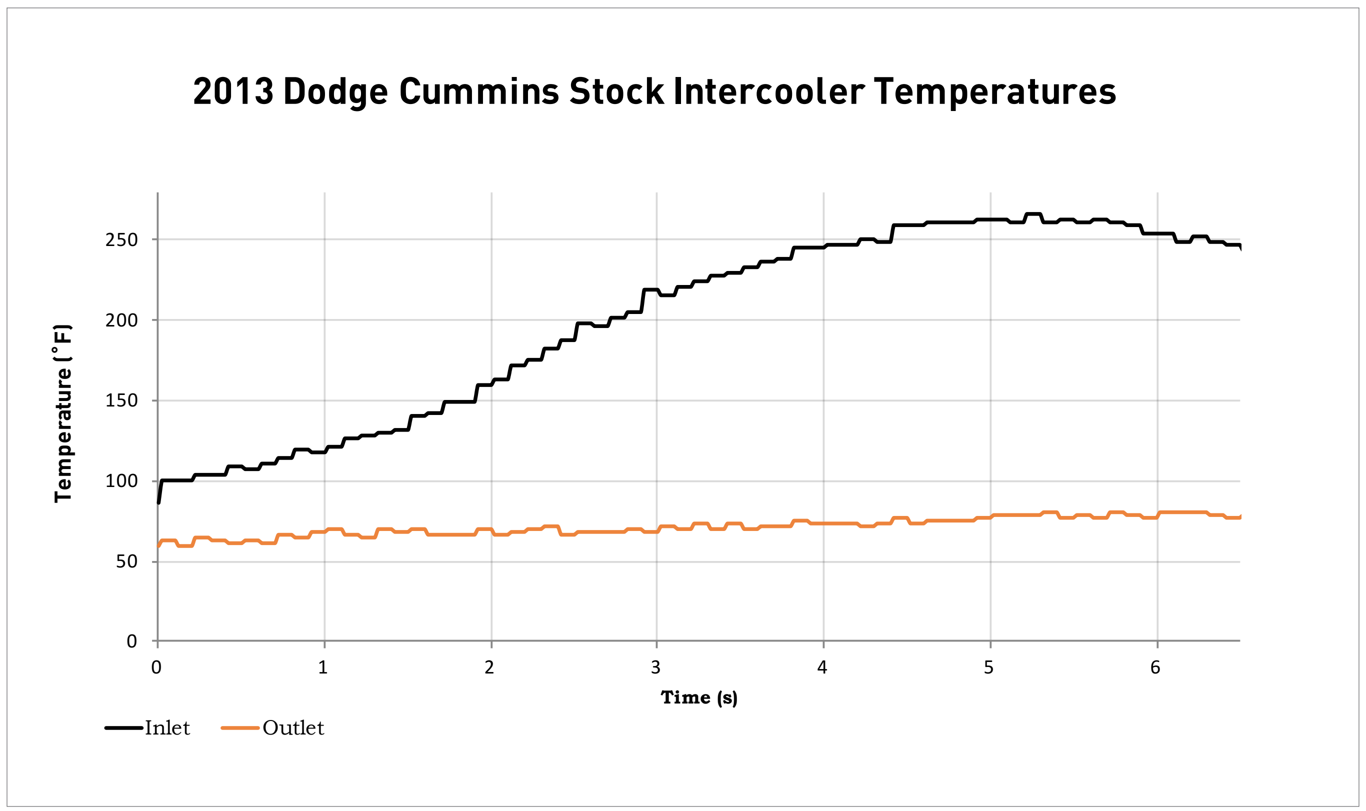

FIGURE 5: *Stock intercooler inlet and outlet temperature data.*

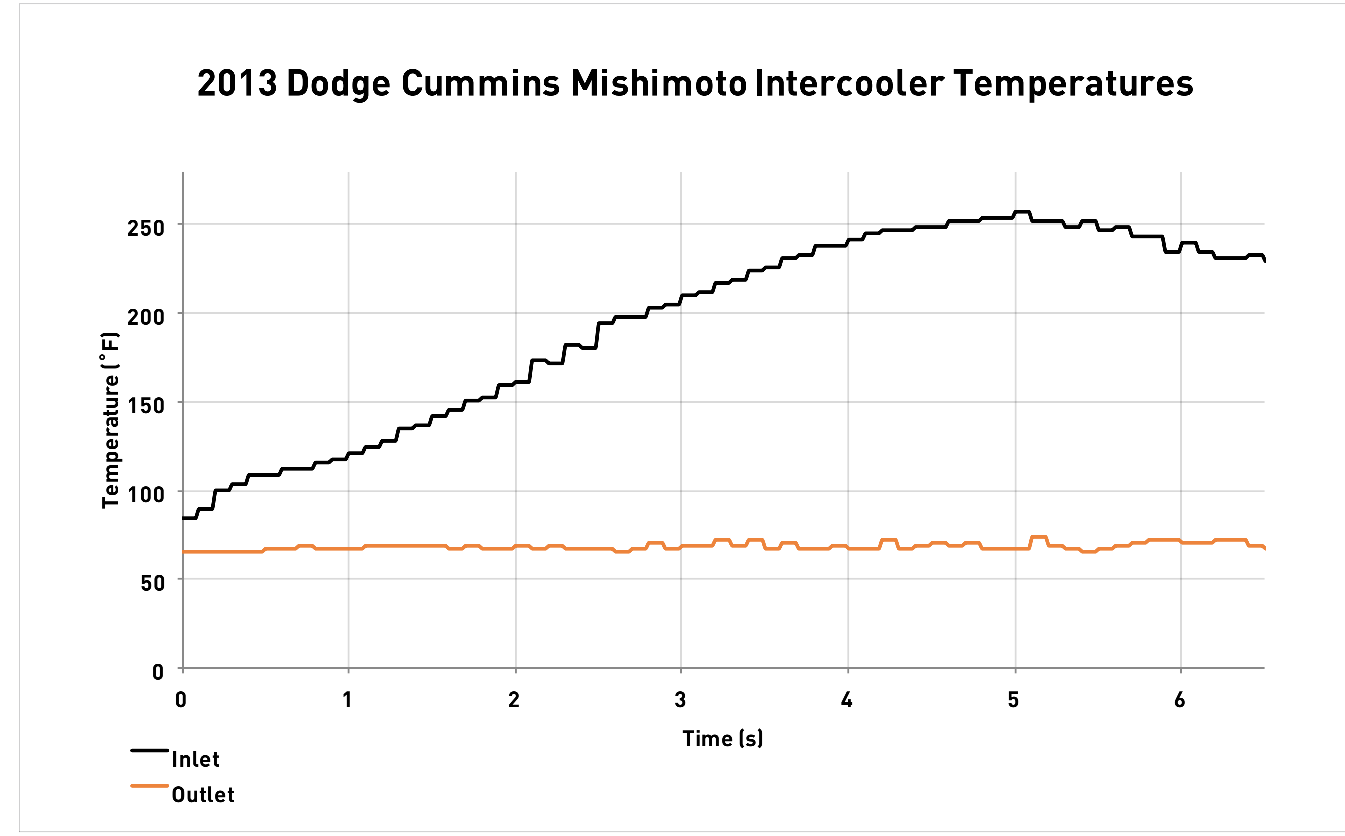

FIGURE 6: *Mishimoto Intercooler inlet and outlet temperature data.*

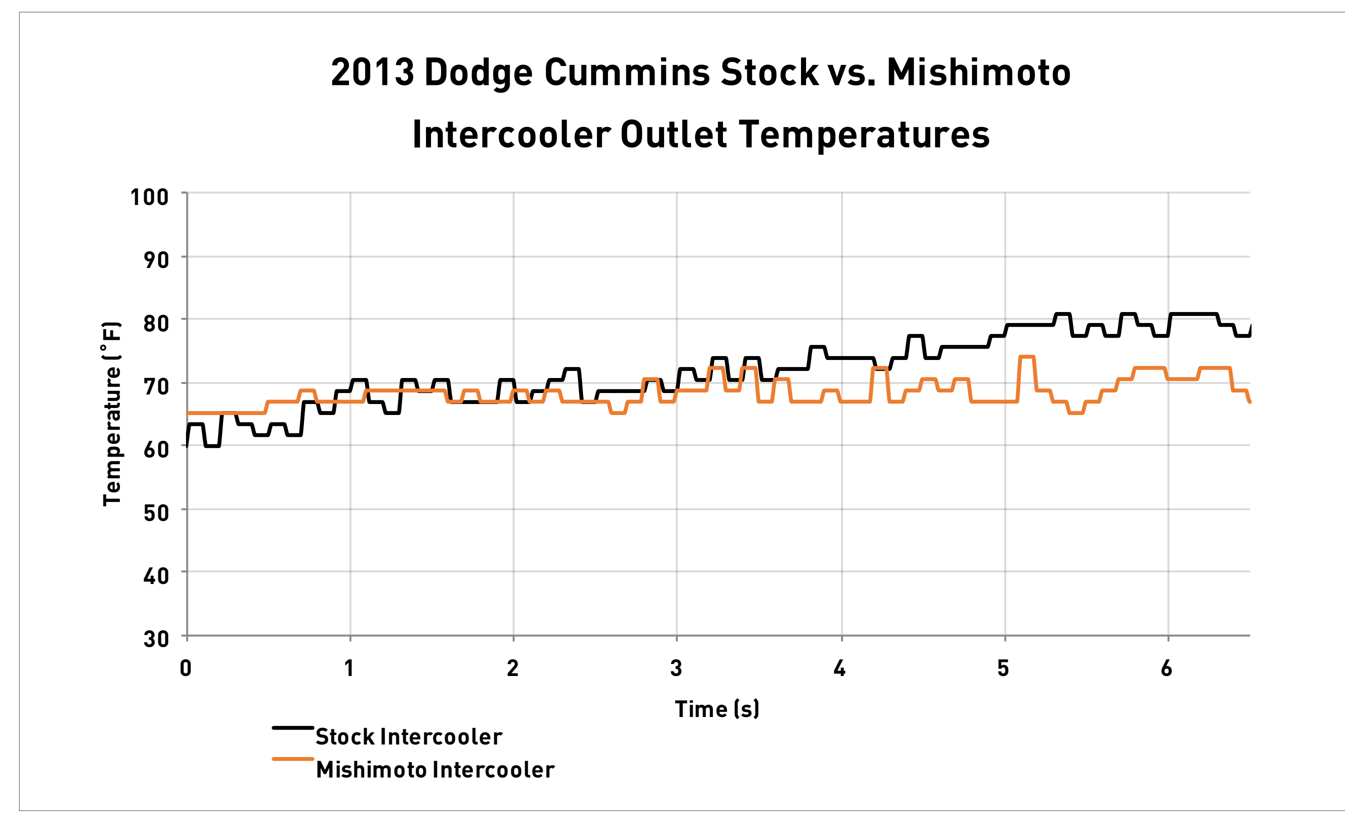

FIGURE 7: *The Mishimoto Intercooler reduced the outlet temperatures about 10°F (5.6°C) compared to the stock intercooler.*

The Mishimoto Intercooler reduced the outlet temperature by 10°F (5.6°C) compared to the stock intercooler. This reduction in temperature is a result of the Mishimoto Intercooler having a 76.65% increase in fin surface area and a 37.8% increase in internal core volume.

Along with temperatures, inlet and outlet pressures were monitored to ensure that the Mishimoto intercooler did not add a significant drop in boost pressure from inlet to outlet. A large decrease in boost pressure could cause the turbo to work harder, which would put additional heat in the engine's cooling and intercooling systems and rob the truck of horsepower.

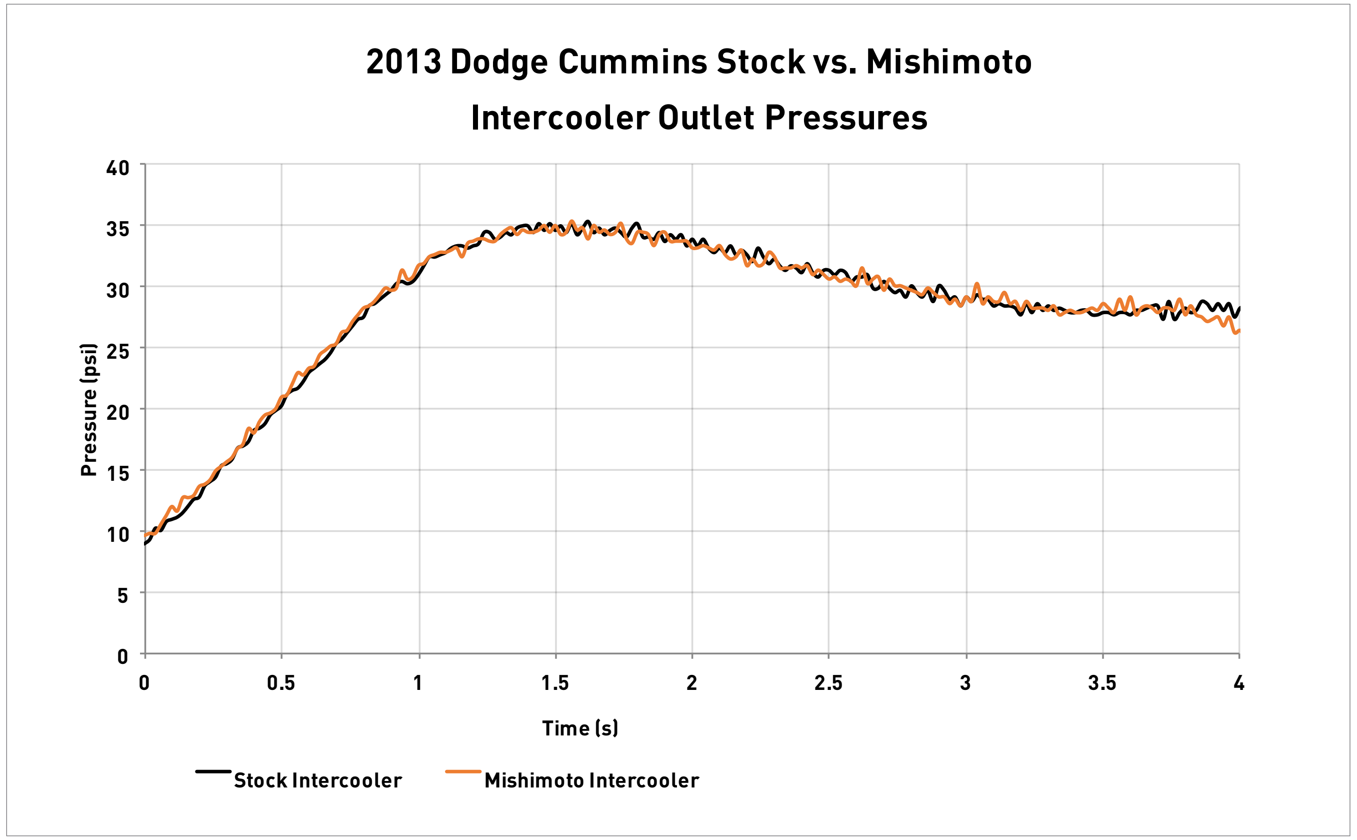

FIGURE 8: *The Mishimoto Intercooler reduced pressure drop by 1% compared to the stock intercooler.*

As seen in Figure 8, the Mishimoto Intercooler follows the outlet pressure curve to within 0.3 psi of the stock intercooler.
An intercooler's primary function is to keep charge-air temperatures low. If the air temperature entering the engine begins to climb, the ECU will reduce power to preserve engine longevity. A performance intercooler will aid in preventing this loss of power on a completely stock tune. The Mishimoto Intercooler reduced outlet temperatures as well as slightly reduced pressure drop compared to the stock intercooler. If an aftermarket tune is loaded onto the truck, additional gains can be expected because the tuner can compensate for the reduction in engine air temperature.

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