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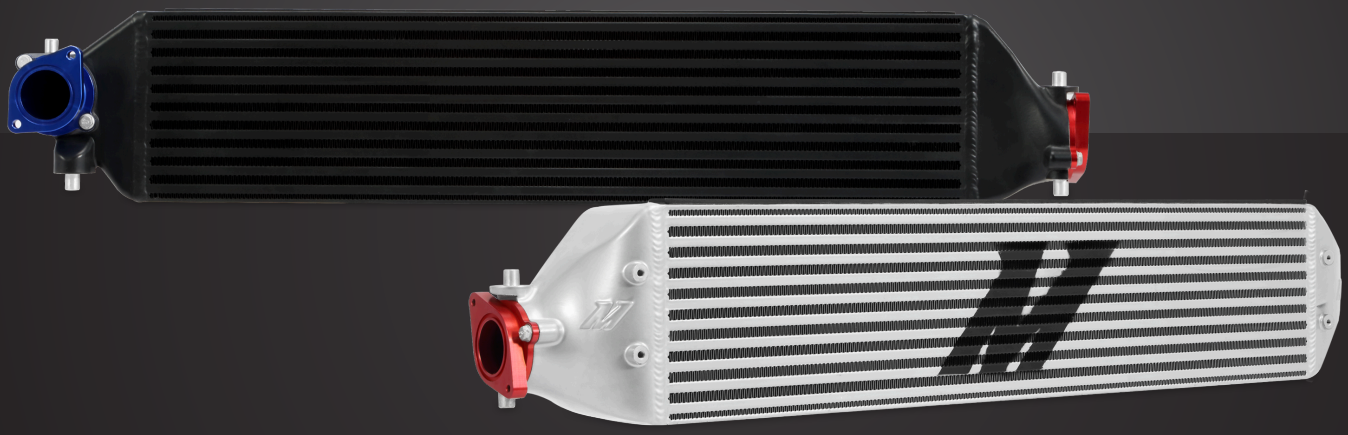

ENGINEERING REPORT

2016+ Honda Civic 1.5T Performance Intercooler | SKU: MMINT-CIV-16

By Daniel Tafe, *Mishimoto Product Engineer*

REPORT AT A GLANCE

- **Goal:** Create a direct-fit performance intercooler that outperforms the stock intercooler and can be mated to the stock intercooler piping.
- **Results:** The Mishimoto Intercooler reduced outlet air temperatures by 20°F (11.1°C) compared to the stock intercooler when tested with a stock tune. With Hondata's +9psi tune on the Civic 1.5T, the reduction in outlet air temperatures increased to 42°F (23.3°C). This reduction in outlet temperature led to max power gains of 3 hp and 8 ft-lb of torque when coupled with stock intercooler piping. With Mishimoto intercooler piping installed and no tune, these gains are 4 hp and 8 ft-lb. When Hondata's + 9psi tune was applied with the Mishimoto intercooler and stock piping, we saw max power gains of 10 hp and 8 ft-lb. With Mishimoto intercooler piping installed, these gains are 11hp and 9 ft-lb.
- **Conclusion:** The Mishimoto intercooler is a great upgrade for anyone looking to get the most performance out of their Civic 1.5T.

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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 able to adapt to the stock intercooler piping.
- 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 standard Honda Civic 1.5T intercooler to find potential room for improvement. The stock intercooler is a 2.5" thick, 7-row tube-and-fin design. The Mishimoto intercooler was designed as a much larger 3.5" thick, 10-row bar-and-plate intercooler to increase the amount of cooling surface area and core volume. This design makes the Mishimoto intercooler 102% larger than the stock Civic 1.5T intercooler. Figures 1 and 2 below show a comparison of overall core volumes and fin surface areas for the stock and Mishimoto intercoolers. Figure 3 shows a physical comparison of the stock intercooler and the Mishimoto intercooler. Figure 4 displays a visual comparison of the efficiency of the stock intercooler and the Mishimoto intercooler.

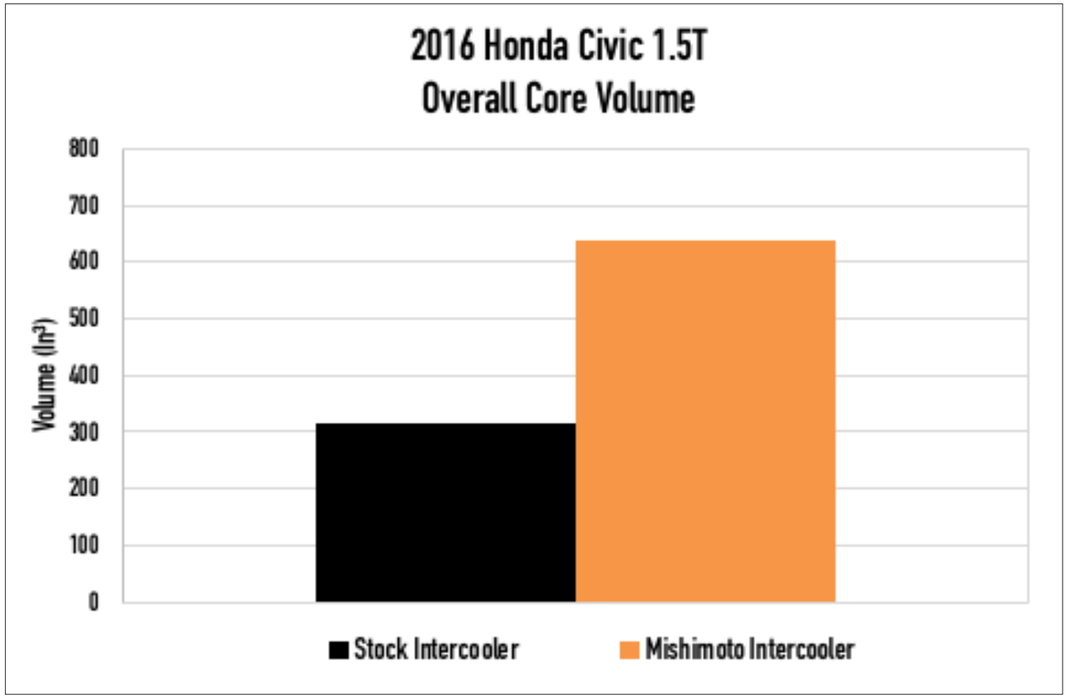

FIGURE 1: *The Mishimoto intercooler has a 102% increase in overall core volume compared to the stock intercooler.*

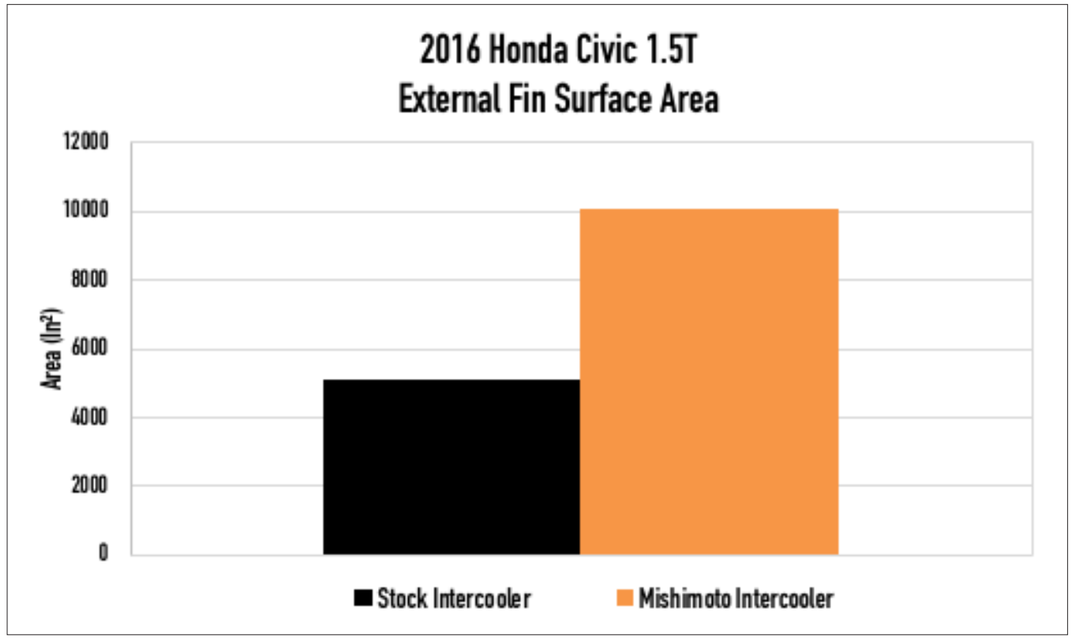

FIGURE 2: *The Mishimoto intercooler has a 97% increase in fin surface area over the stock intercooler.*

FIGURE 3: *Comparison of the stock intercooler to the Mishimoto intercooler.*

FIGURE 4: *The Mishimoto intercooler has a 102% increase in overall core volume compared to the stock intercooler.*

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 Mishimoto intercooler. 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 5: *AEM AQ-1 Data Logging System*

FIGURE 6: *Pressure and temperature sensors installed in hot-side intercooler pipe.*

PERFORMANCE TESTING

A 2016 Honda Civic 1.5T was used to test each intercooler setup. The ambient temperature on the day of testing was approximately 68°F (20°C). To test the performance of the intercoolers, a Dynapack™ dynamometer was used to conduct consistent ramp tests.

FIGURE 7: *A Dynapack dynamometer was used for vehicle testing.*

The Civic 1.5T was warmed up by idling it on the dyno until the coolant temperature reached 180°F (82.2°C). Once the car was warmed up, multiple dyno runs were conducted until consistent figures were recorded. The car was kept running between runs to maintain a consistent engine coolant temperature for every run. As a final test for each test configuration, dyno runs were made back to back with just 20 seconds between runs to simulate heat-soak conditions. Below is a list of the configurations tested on the Civic 1.5T.

Configuration	Stock Intercooler	Stock Intercooler Piping	Stock Tune	Mishimoto Intercooler	Mishimoto Intercooler Piping	Hondata +9 psi
1	X	X	X			
2		X	X	X		
3			X	X	X	
4				X	X	X
5		X		X		X
6	X	X				X

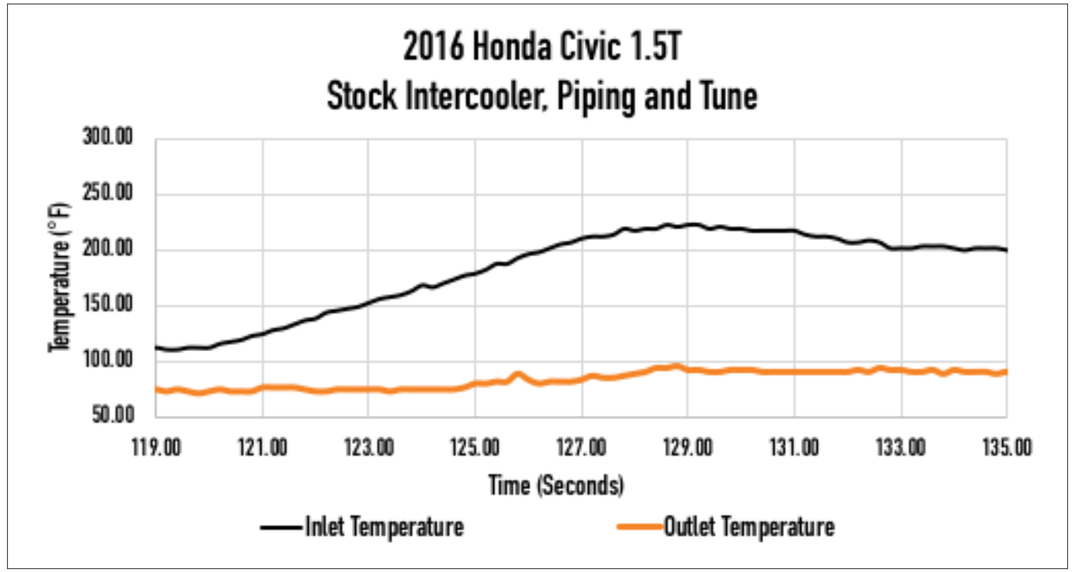

FIGURE 8: *Stock intercooler, piping, and tune inlet and outlet temperature data.*

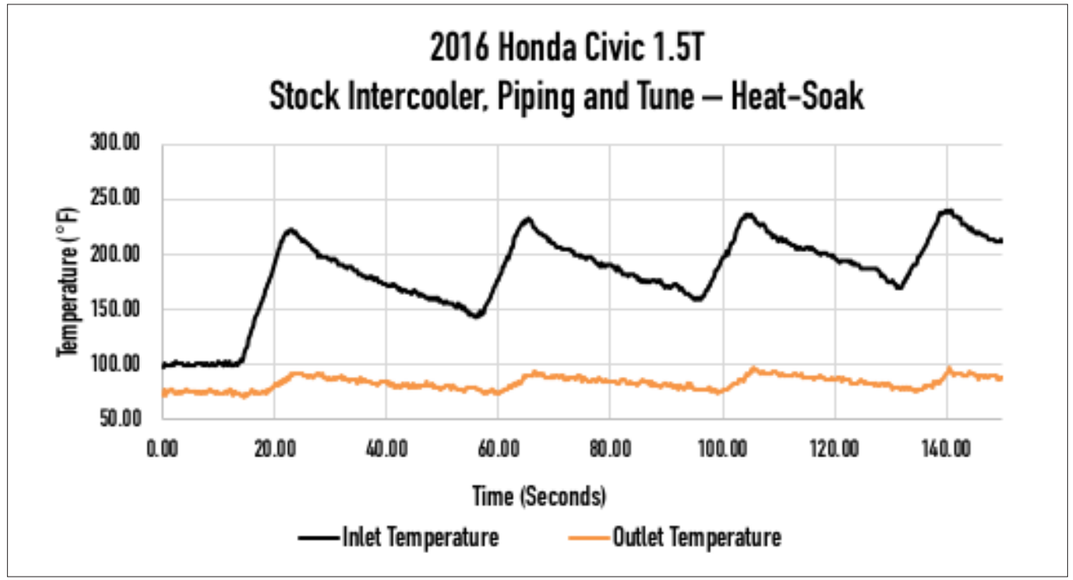

FIGURE 9: *Stock intercooler, piping, and tune inlet and outlet temperature data (heat-soak test).*

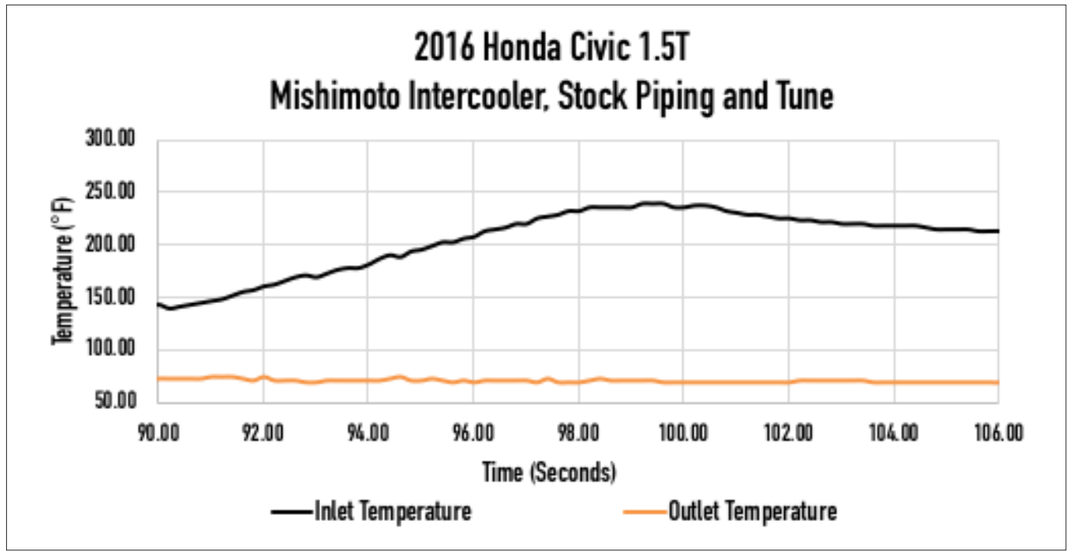

FIGURE 10: *Mishimoto intercooler, stock piping, and tune inlet and outlet temperature data.*

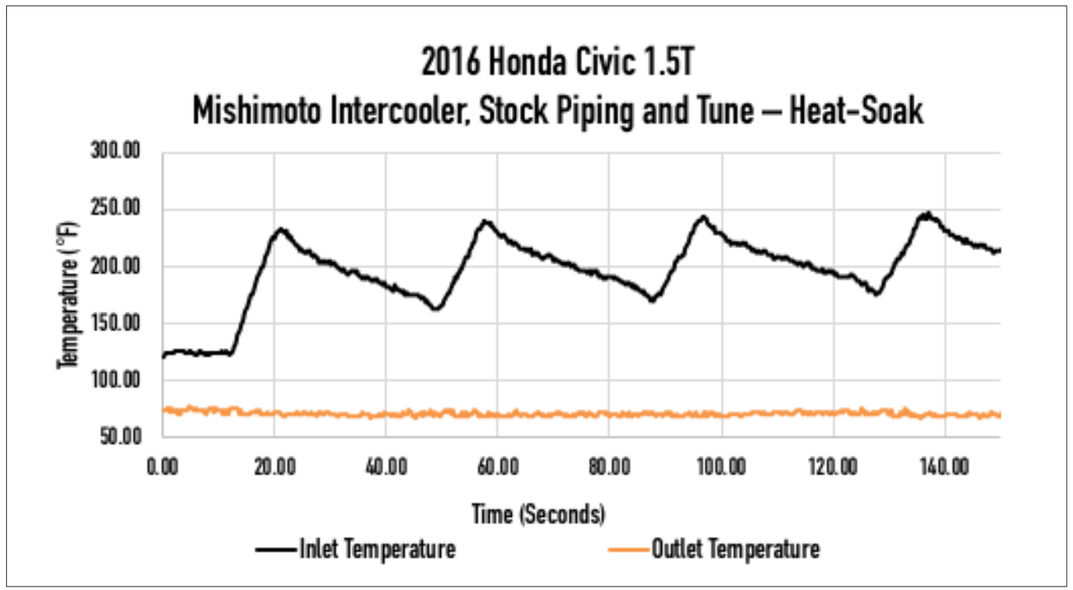

FIGURE 11: *Mishimoto intercooler, stock piping, and tune inlet and outlet temperature data (heat-soak test).*

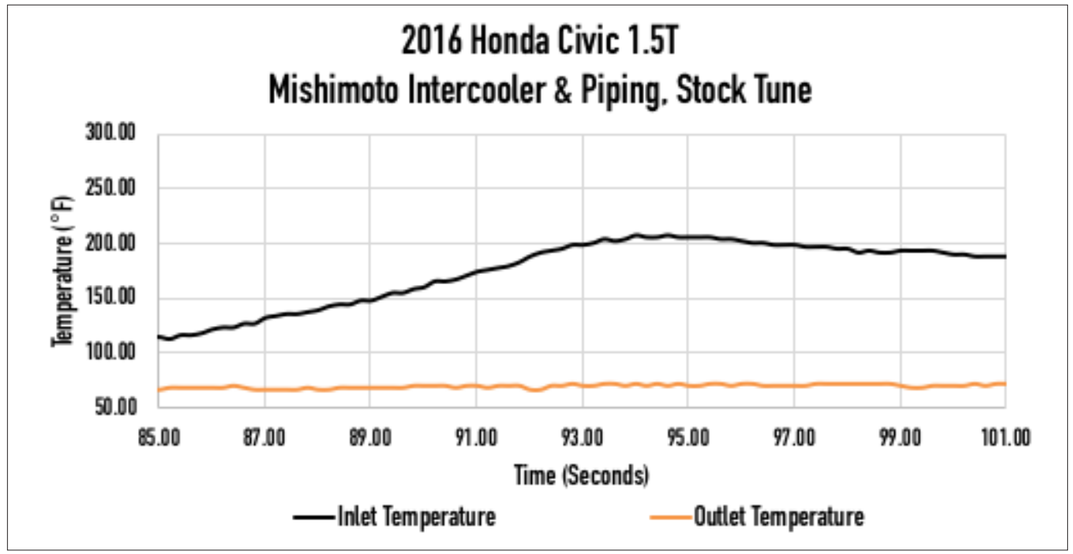

FIGURE 12: *Mishimoto intercooler, piping, and stock tune inlet and outlet temperature data.*

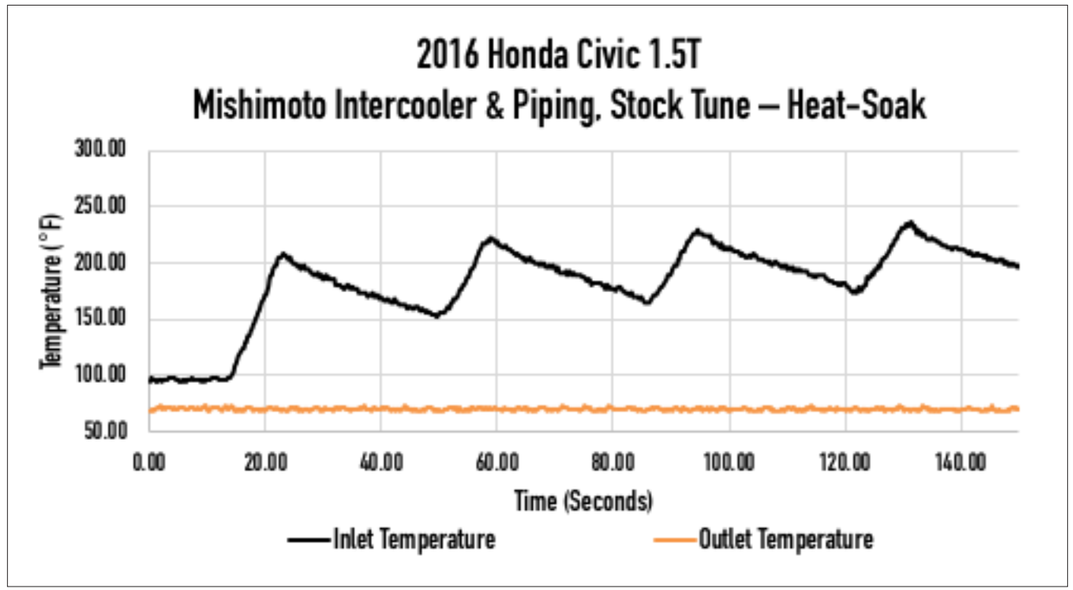

FIGURE 13: *Mishimoto intercooler, piping, and stock tune inlet and outlet temperature data (heat-soak test).*

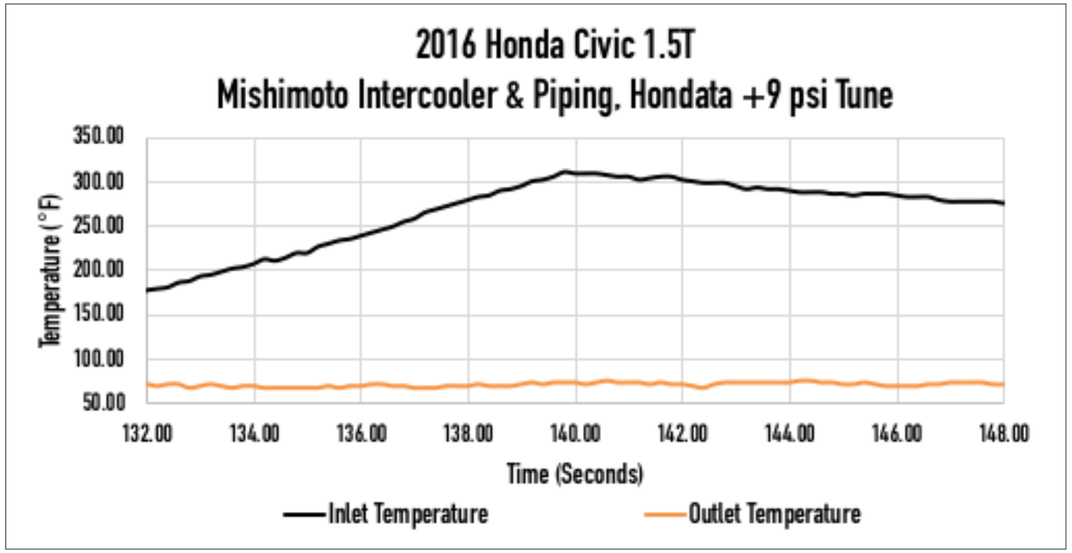

FIGURE 14: *Mishimoto intercooler, piping, and Hondata +9 psi tune inlet and outlet temperature data.*

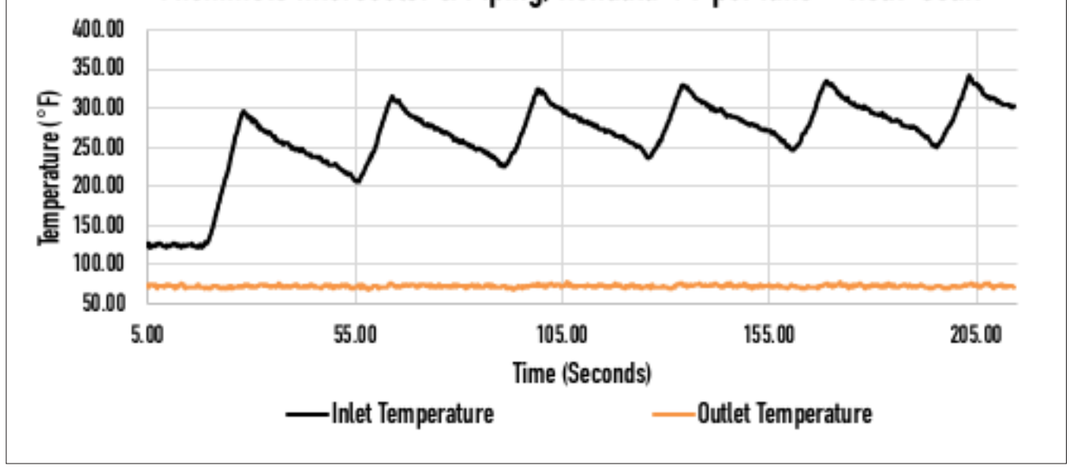

FIGURE 15: *Mishimoto intercooler, piping, and Hondata +9 psi tune inlet and outlet temperature data (heat-soak test).*

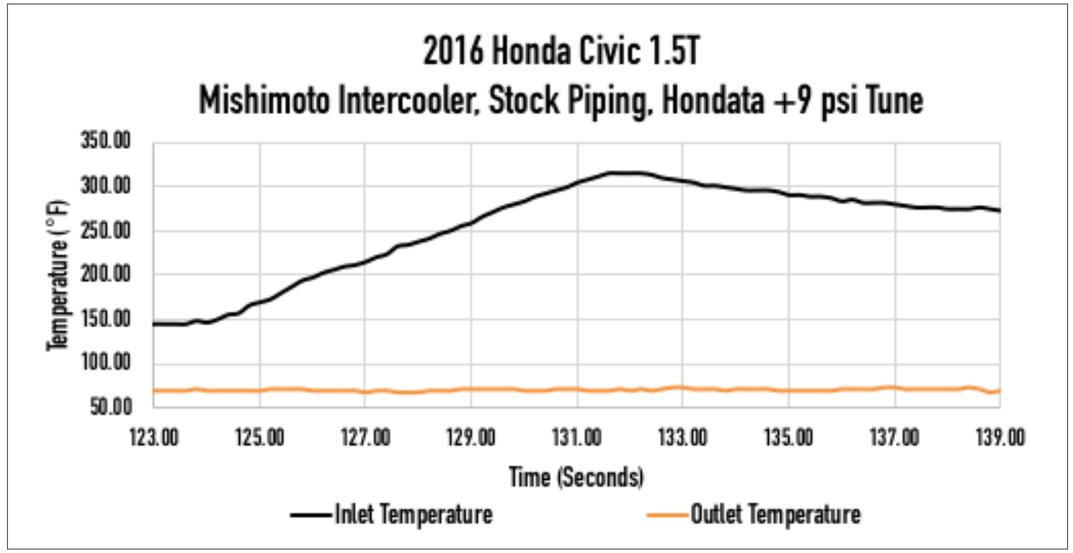

FIGURE 16: *Mishimoto intercooler, stock piping, and Hondata +9 psi tune inlet and outlet temperature data.*

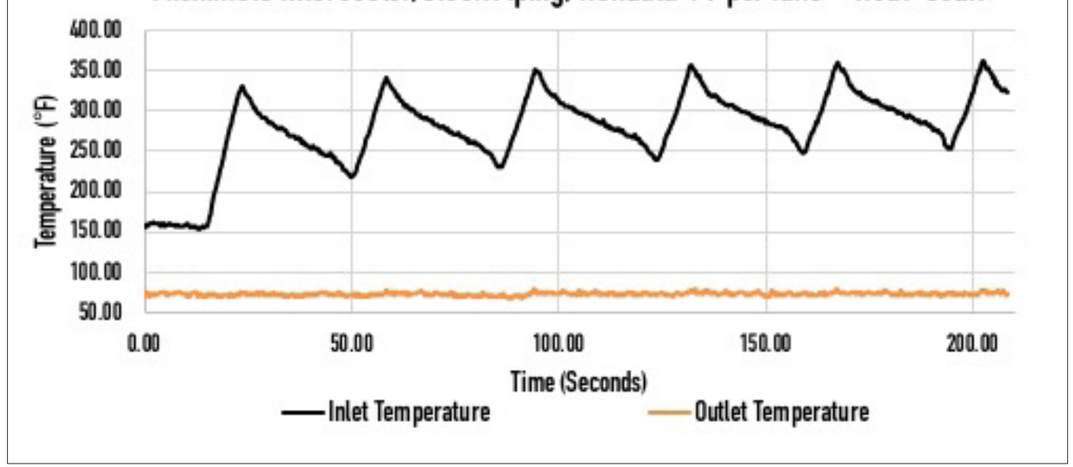

FIGURE 17: *Mishimoto intercooler, stock piping, and Hondata +9 psi tune inlet and outlet temperature data (heat-soak test).*

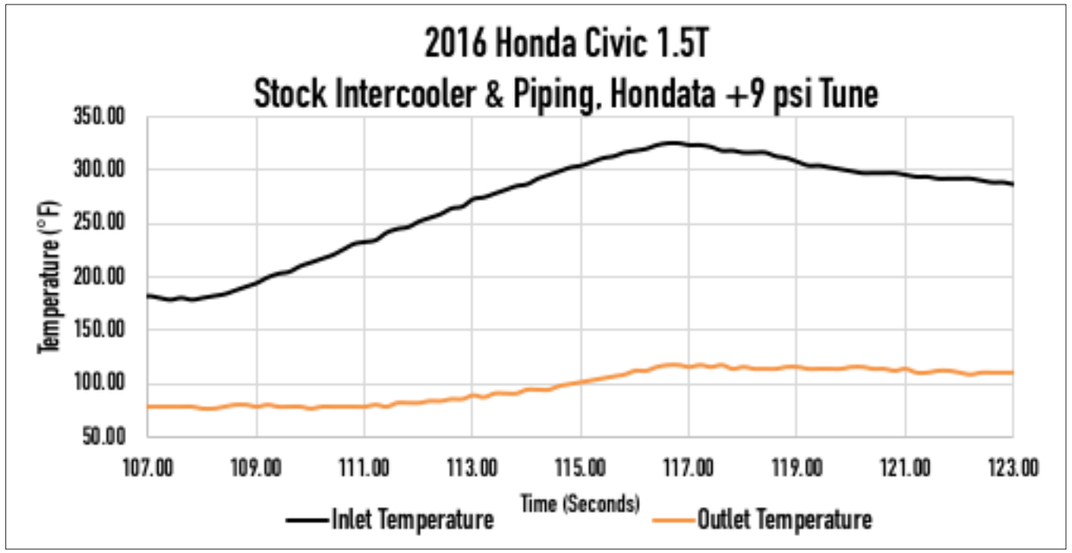

FIGURE 18: *Stock intercooler, piping, and Hondata +9 psi tune inlet and outlet temperature data.*

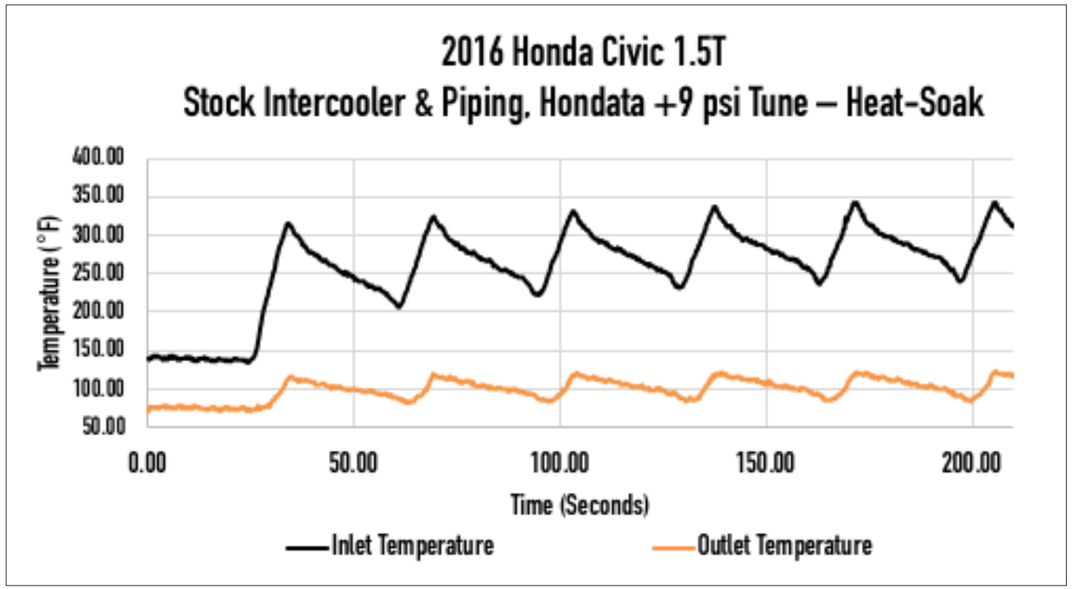

FIGURE 19: *Stock intercooler, piping, and Hondata +9 psi tune inlet and outlet temperature data (heat-soak test).*

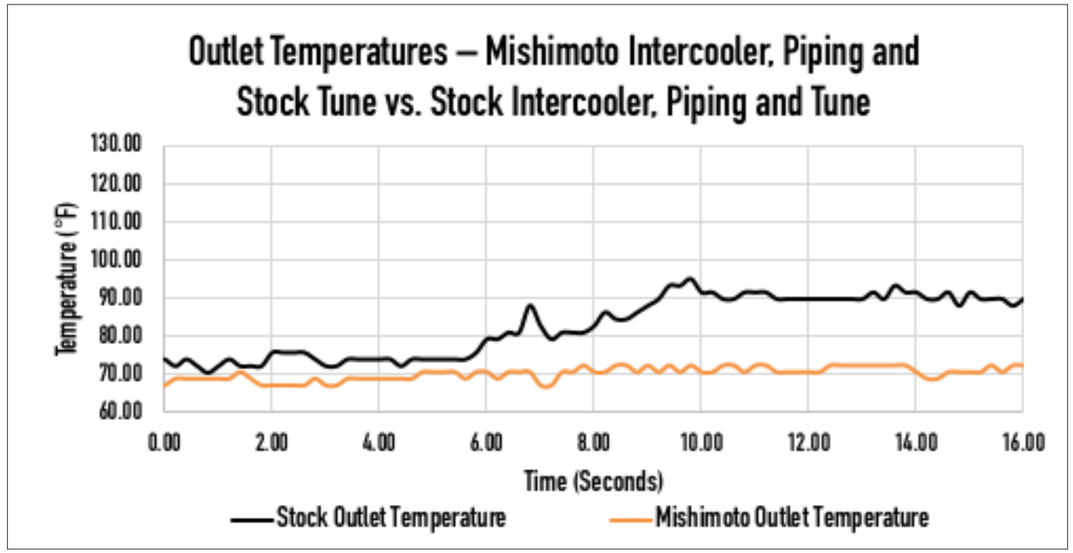

FIGURE 20: *The Mishimoto intercooler reduced the outlet temperatures about 20°F (11.1°C) compared to the stock intercooler.*

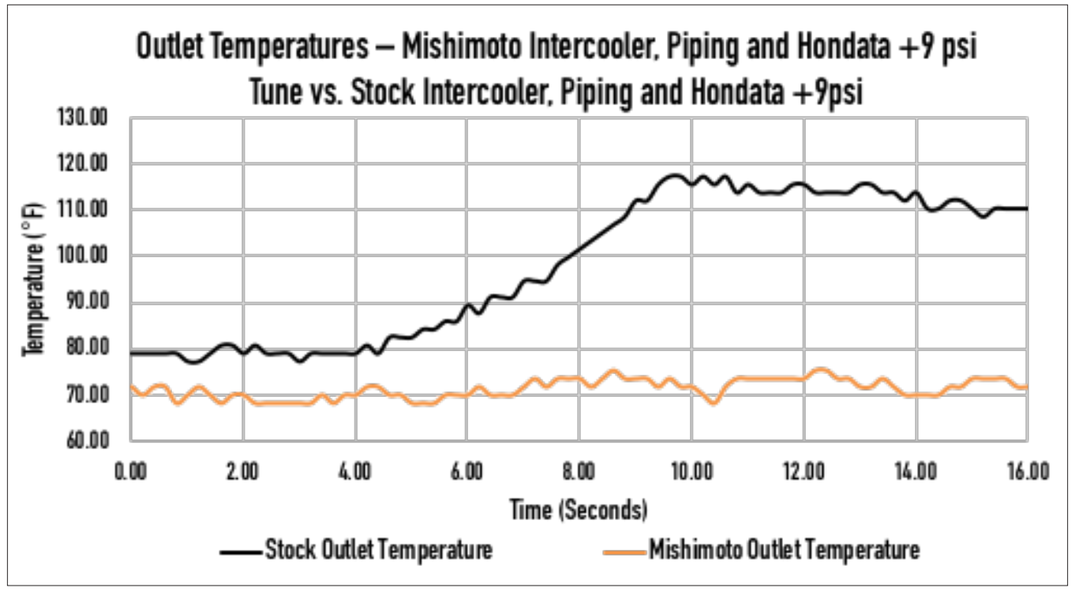

FIGURE 21: *The Mishimoto intercooler reduced the outlet temperatures about 42°F (22.2°C) compared to the stock intercooler when tuned with Hondata's +9 psi tune.*

In comparison to the stock intercooler, the Mishimoto intercooler reduced the outlet temperature by 20˚F (11.1˚C) when tested with the stock tune and 40˚F (23.3˚C) when tested with Hondata's +9psi tune. This reduction in temperature is a result of the Mishimoto intercooler having a 97% increase in fin surface area and an 102% increase in 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 have to work harder, causing additional heat to be put into the engine cooling and intercooling system as well as rob the car of horsepower.

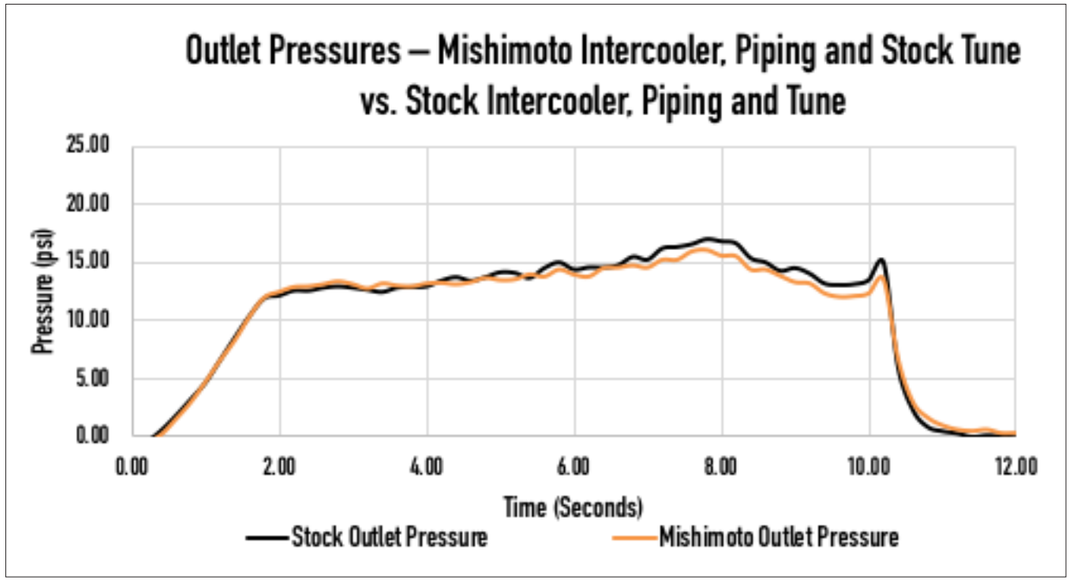

FIGURE 22: *The Mishimoto intercooler had an additional 1 psi of boost pressure drop compared to the stock intercooler.*

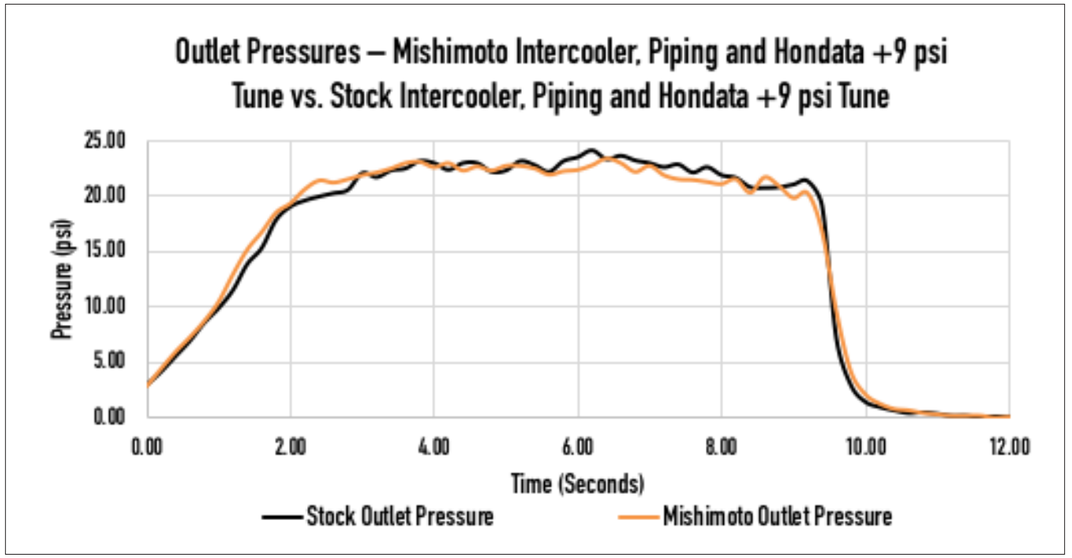

FIGURE 23: *The Mishimoto intercooler had an additional 1 psi of boost pressure drop compared to the stock intercooler when tuned with Hondata's +9 psi tune.*

As seen in Figures 22 and 23, the Mishimoto intercooler follows the outlet pressure curve to within 1 psi of the stock cooler. This is well within an acceptable range and will not have any adverse effects on the intercooling system of the Civic 1.5T.

As a bonus to go along with the reduction in outlet temperatures, the Mishimoto intercooler yielded max power gains of 7 hp and 8 ft-lb of torque. With a cooler intercooler charge, the engine can pack more air and fuel mix into the cylinders, which creates the potential to make a little extra power.

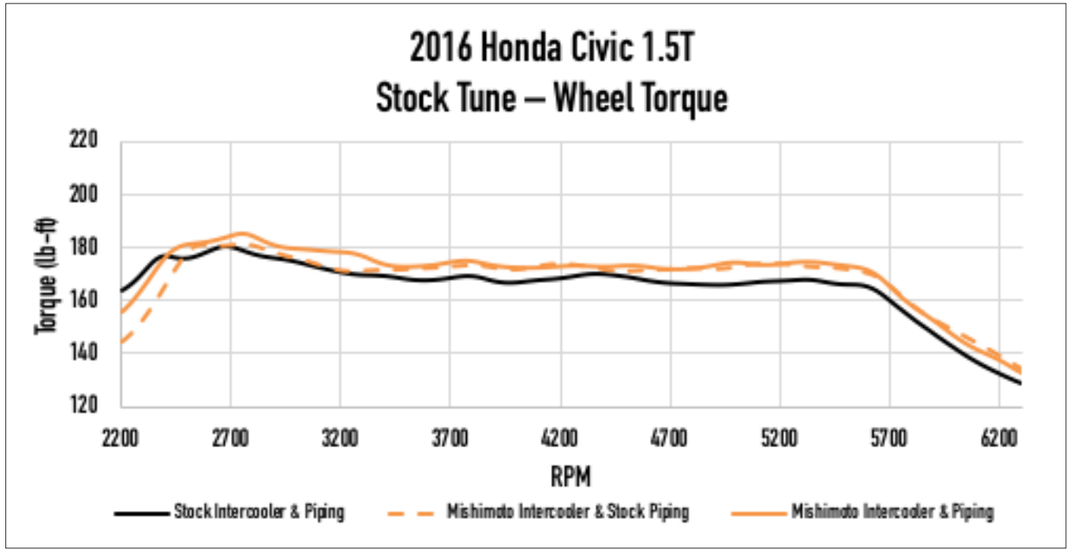

FIGURE 24: *The Mishimoto intercooler yielded a peak gain of 2 ft-lb and max gain of 8 ft-lb. When coupled with the Mishimoto intercooler piping, these gains increased to a peak gain of 5 ft-lb and max gain of 8 ft-lb.*

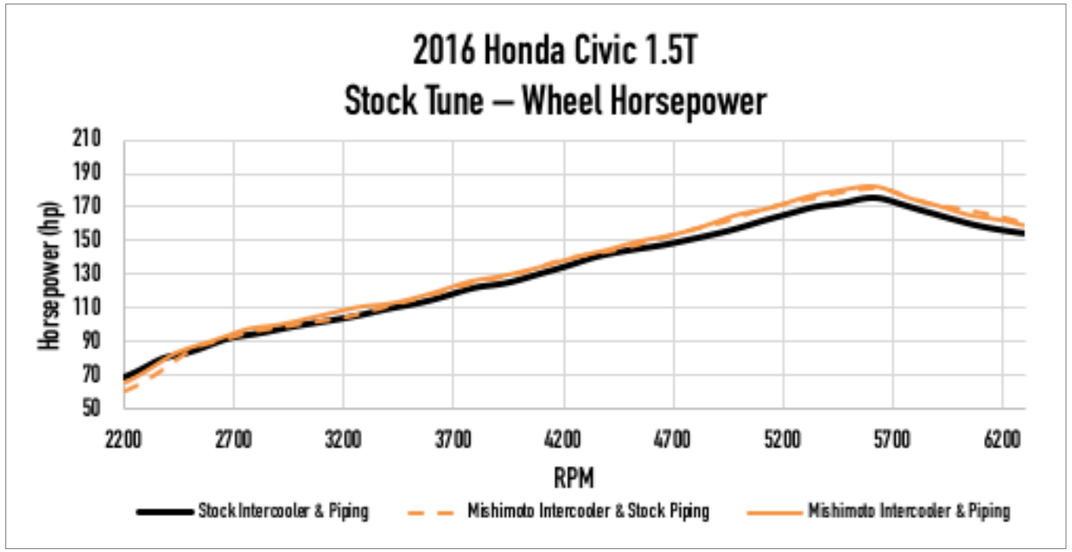

FIGURE 25: *The Mishimoto intercooler yielded a peak gain of 6 hp and max gain of 3 hp. When coupled with the Mishimoto intercooler piping, these gains increased to a peak gain of 7 hp and max gain of 4 hp.*

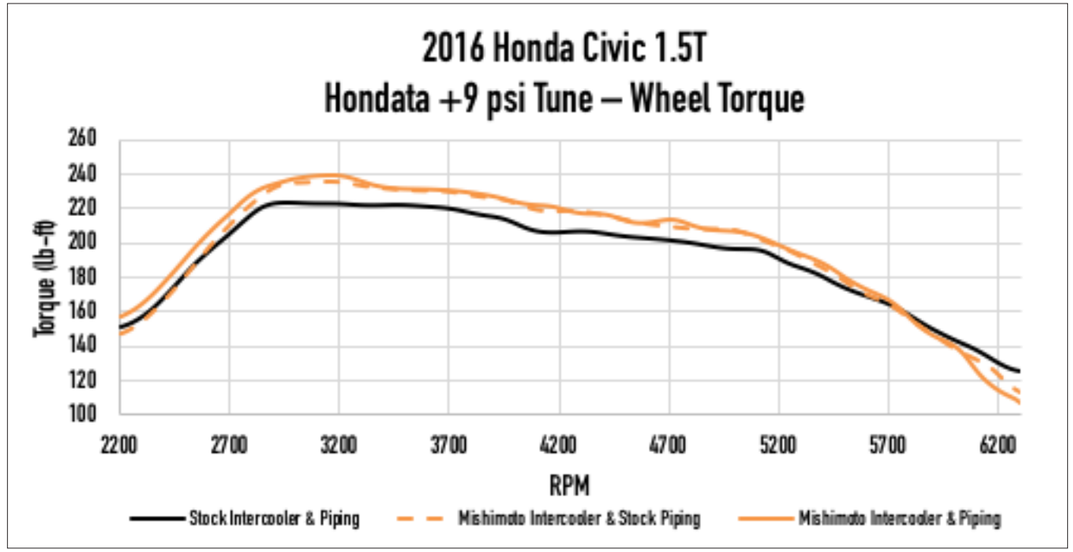

FIGURE 26: *The Mishimoto intercooler yielded a peak gain of 11 ft-lb and max gain of 8 ft-lb. When coupled with the Mishimoto intercooler piping, these gains increased to a peak gain of 15 ft-lb and max gain of 9 ft-lb.*

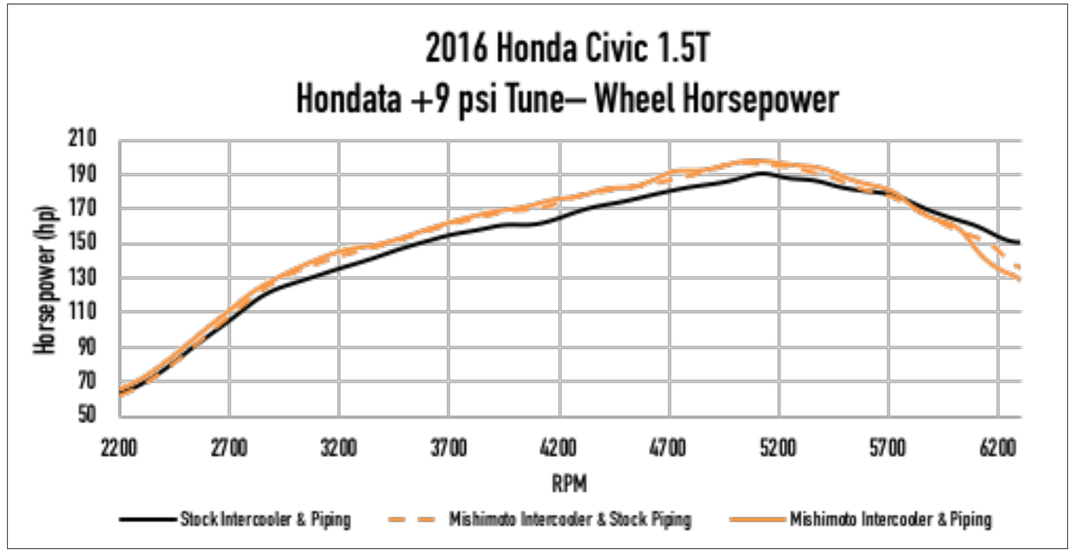

FIGURE 27: *The Mishimoto intercooler yielded a peak gain of 7 hp and max gain of 10 hp. When coupled with the Mishimoto intercooler piping, these gains increased to a peak gain of 7 hp and max gain of 11 hp.*

FIGURE 28: *Mishimoto intercooler installed on car.*

FIGURE 25: *Mishimoto intercooler piping as seen through the passenger-side grille opening.*

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 with a minimal increase in boost pressure drop, resulting in a slight gain in horsepower and torque with the stock tune. If an aftermarket tune is loaded onto the vehicle, additional gains can be expected because the tuner is able to compensate for the reduction in engine air temperature.

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