ENGINEERING REPORT

2017+ Honda Civic Type R Performance Intercooler | SKU: MMINT-CTR-17

By Daniel Tafe, *Mishimoto Product Engineer*

REPORT AT A GLANCE

- **Goal:** Create a direct-fit performance intercooler that outperforms the stock intercooler.
- **Results:** The Mishimoto intercooler and piping reduced outlet air temperatures by 53°F (29°C) compared to the stock intercooler and piping. This reduction in outlet temperature led to max power gains of 10 hp and 10 ft-lb of torque.
- **Conclusion:** The Mishimoto intercooler is a great upgrade for drivers looking to get the most performance out of their Civic Type R.

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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 FITMENT

We began the R&D process by evaluating the stock Honda Civic Type R intercooler to find potential room for improvement. The stock intercooler is a 2.50" thick, 9-row tube-and-fin design. The Mishimoto intercooler was designed as a much larger 4.70" thick, 12-row bar-and-plate intercooler to increase the amount of cooling surface area and core volume. This design makes the Mishimoto intercooler 169% larger than the stock Civic Type R 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 efficiencies of the stock intercooler and the Mishimoto intercooler.

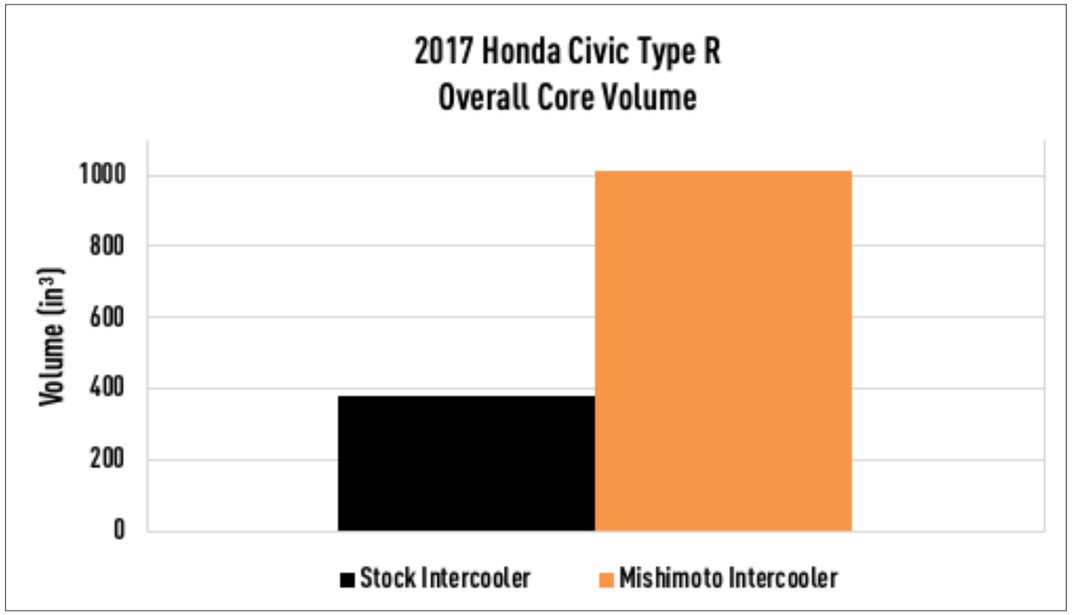

FIGURE 1: *The Mishimoto intercooler has a 169% increase in overall core volume compared to the stock intercooler.*

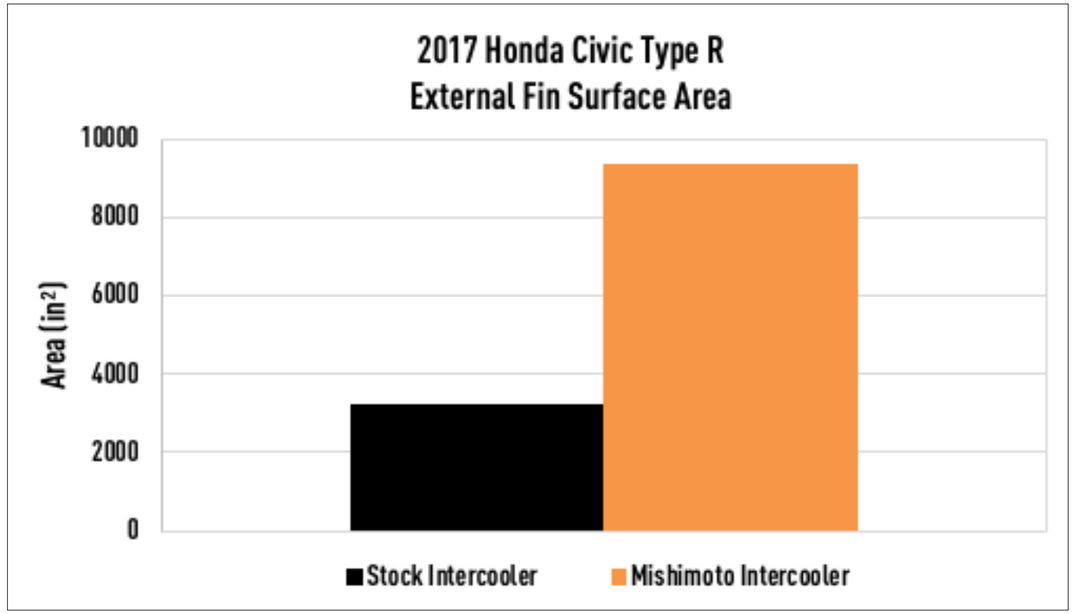

FIGURE 2: *The Mishimoto intercooler has a 189% increase in fin surface area over the stock intercooler.*

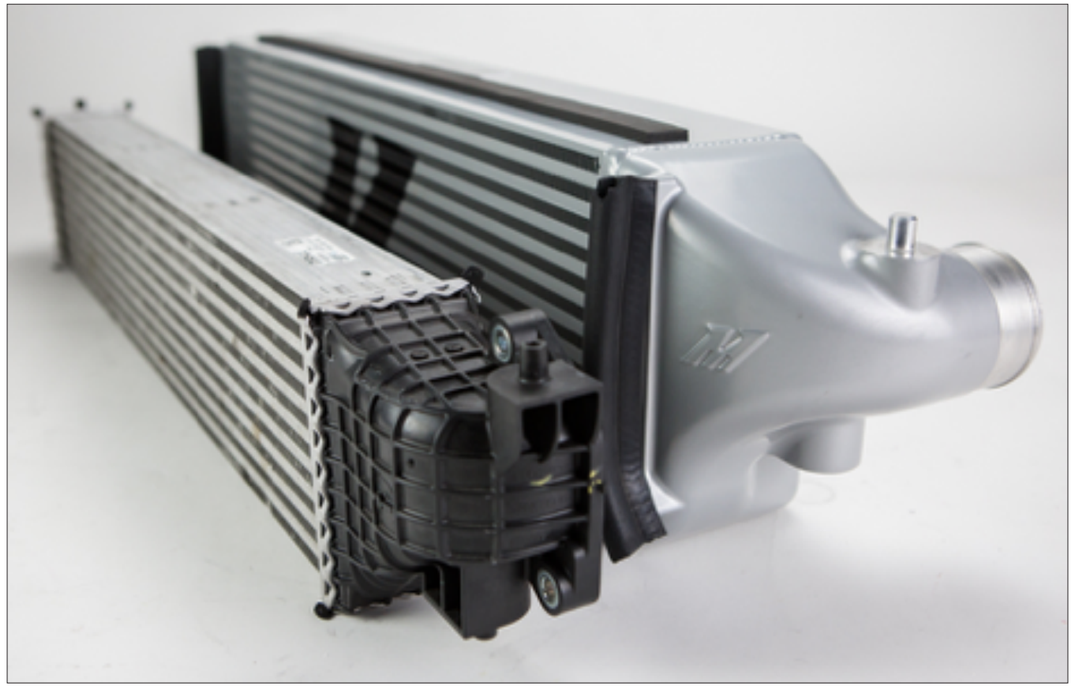

FIGURE 3: *Comparison of the stock intercooler to the Mishimoto intercooler.*

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*

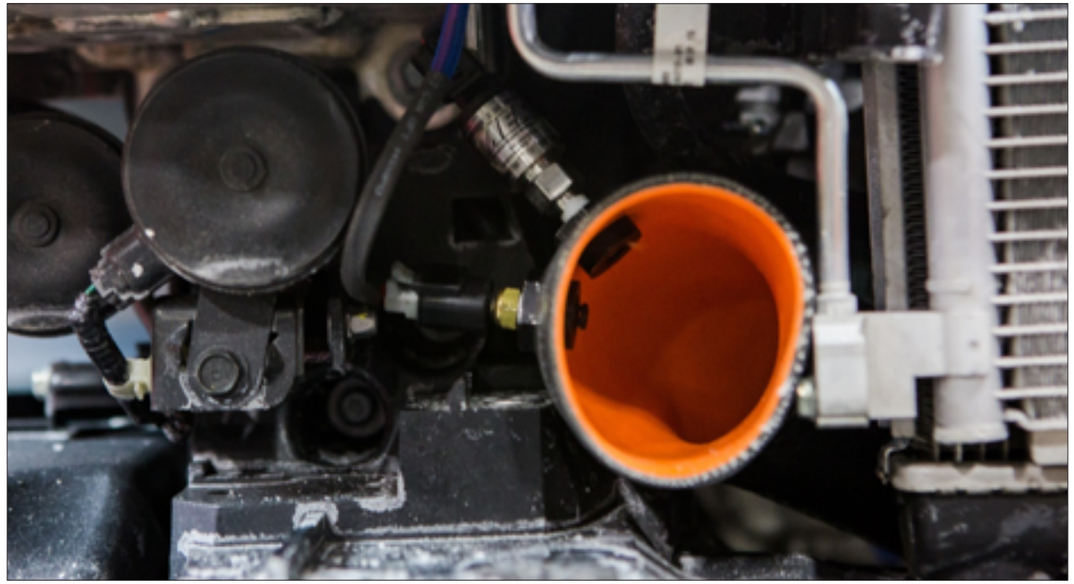

FIGURE 6: *Pressure and temperature sensors installed in hot-side intercooler pipe.*

PERFORMANCE TESTING

A 2017 Honda Civic Type R 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 Type R was warmed up by idling it on the dyno until the coolant temperature reached 180˚F (82˚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. The two configurations we tested were:

Configuration 1 – Stock intercooler with stock intercooler piping

Configuration 2 – Mishimoto intercooler with Mishimoto intercooler piping

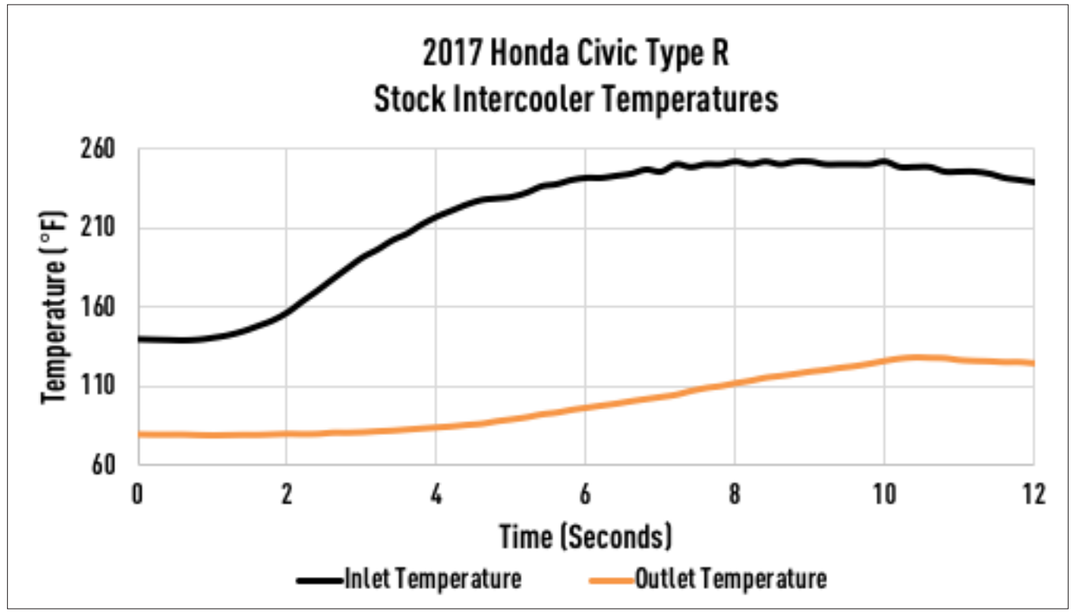

FIGURE 8: *Inlet and outlet temperature data for stock intercooler and piping.*

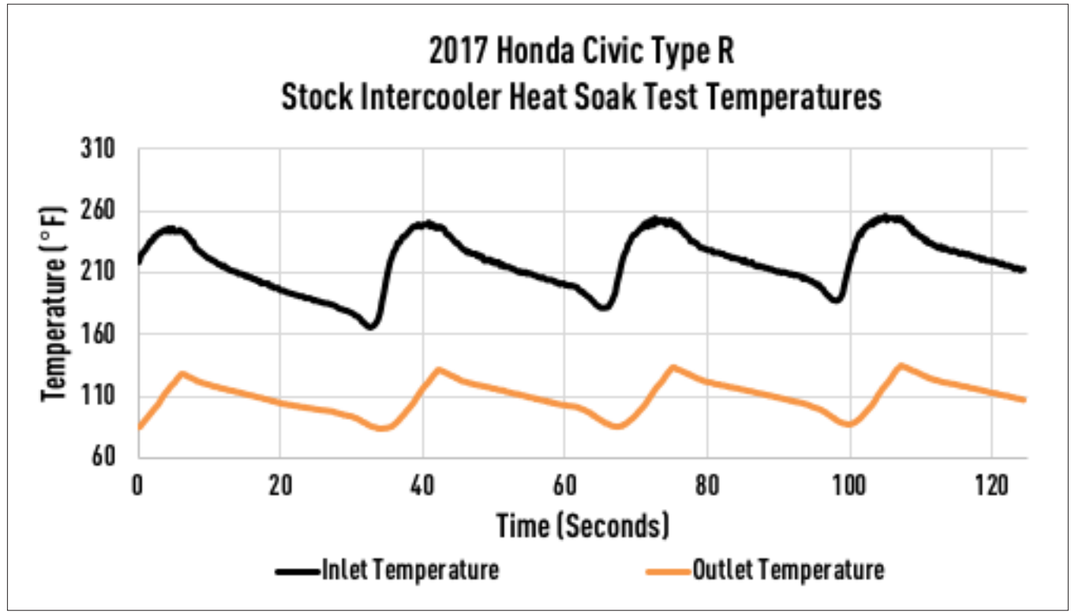

FIGURE 9: *Inlet and outlet temperature data (heat-soak test) for stock intercooler and piping.*

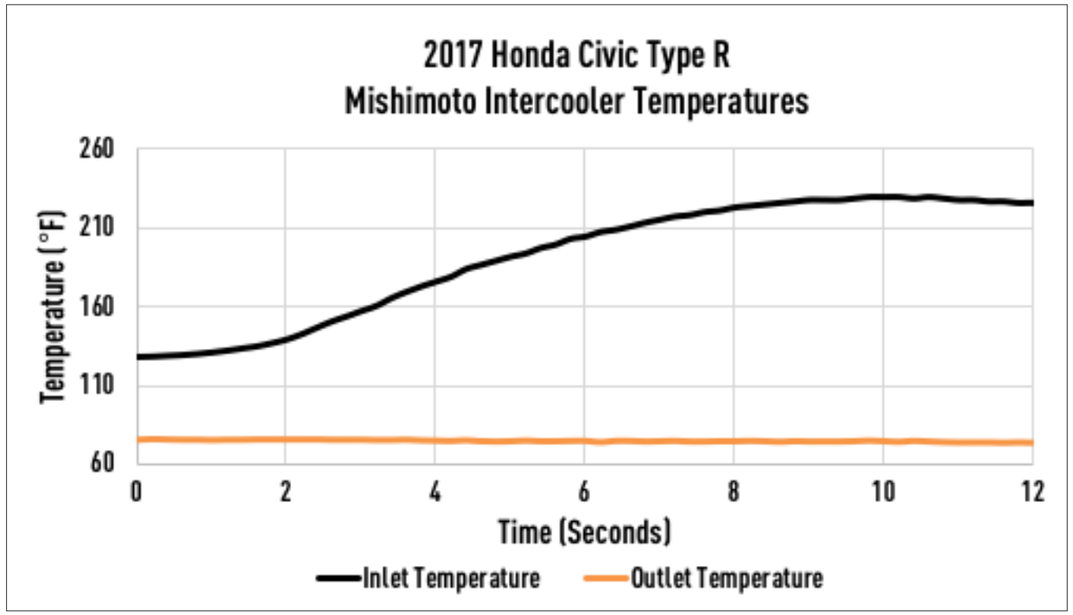

FIGURE 10: *Inlet and outlet temperature data for Mishimoto intercooler and piping.*

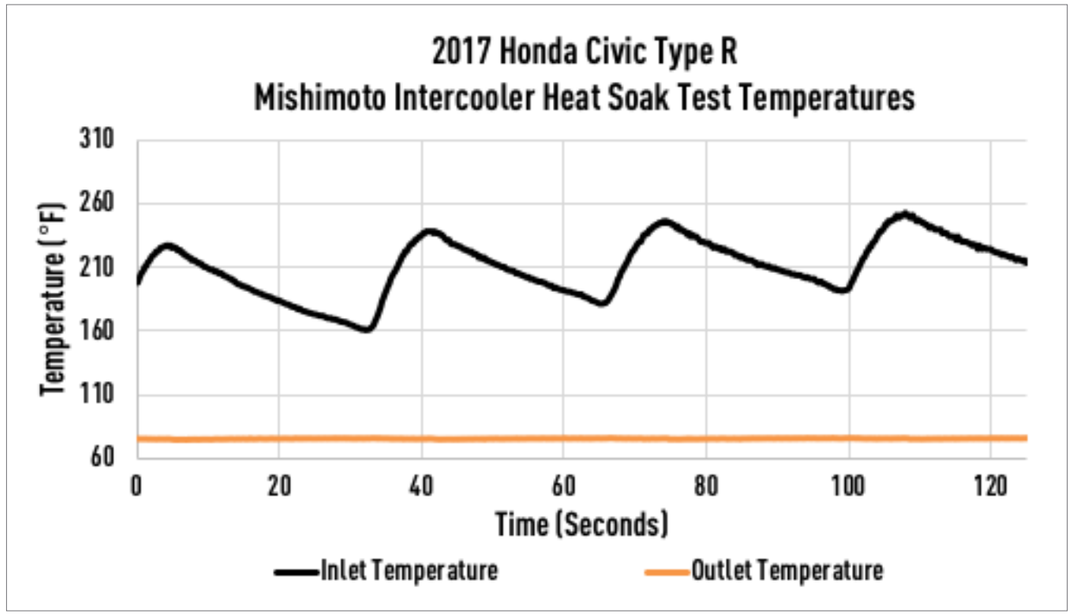

FIGURE 11: *Inlet and outlet temperature data (heat-soak test) for Mishimoto intercooler and piping.*

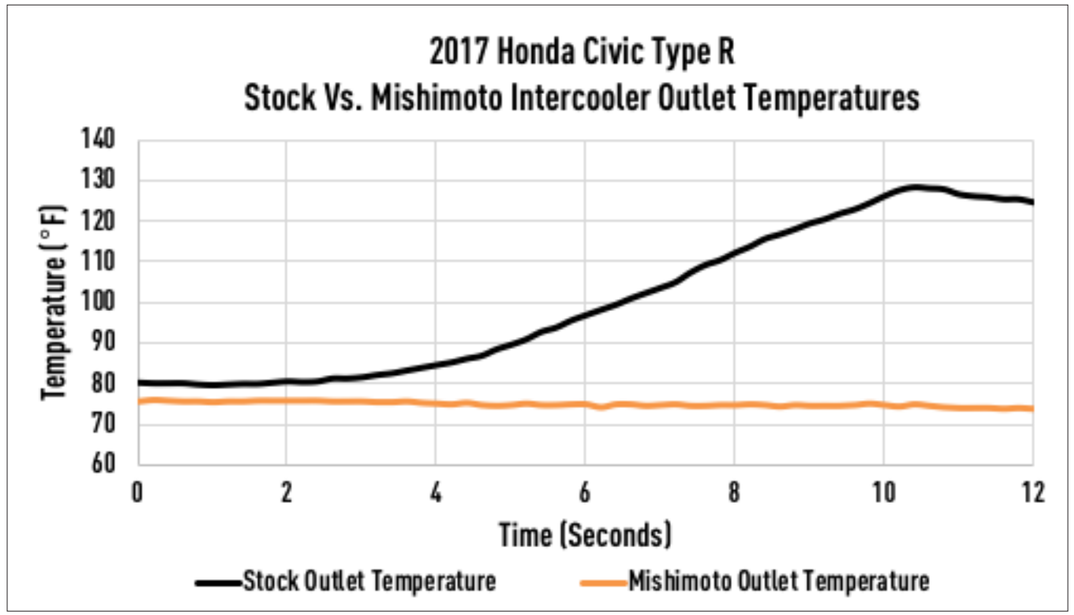

FIGURE 12: *The Mishimoto intercooler and piping reduced the outlet temperatures by about 53°F (29°C) compared to the stock intercooler and piping.*

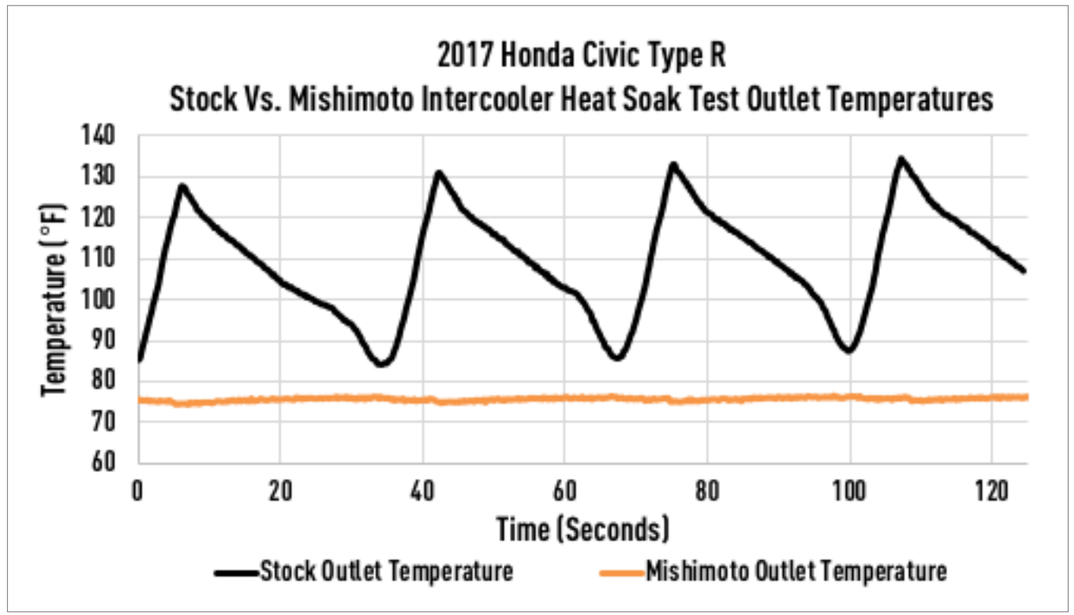

FIGURE 13: *The Mishimoto intercooler and piping reduced the outlet temperatures by about 58°F (32°C) compared to the stock intercooler and piping.*

In comparison to the stock intercooler and piping, the Mishimoto intercooler and piping reduced the outlet temperature by 53°F (29°C). This reduction in temperature is a result of the Mishimoto intercooler having a 189% increase in fin surface area and a 169% increase in overall core volume.

Along with temperatures, inlet and outlet pressures were monitored to ensure that the Mishimoto intercooler did not cause 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 into the engine's cooling and intercooling systems and would also reduce the horsepower.

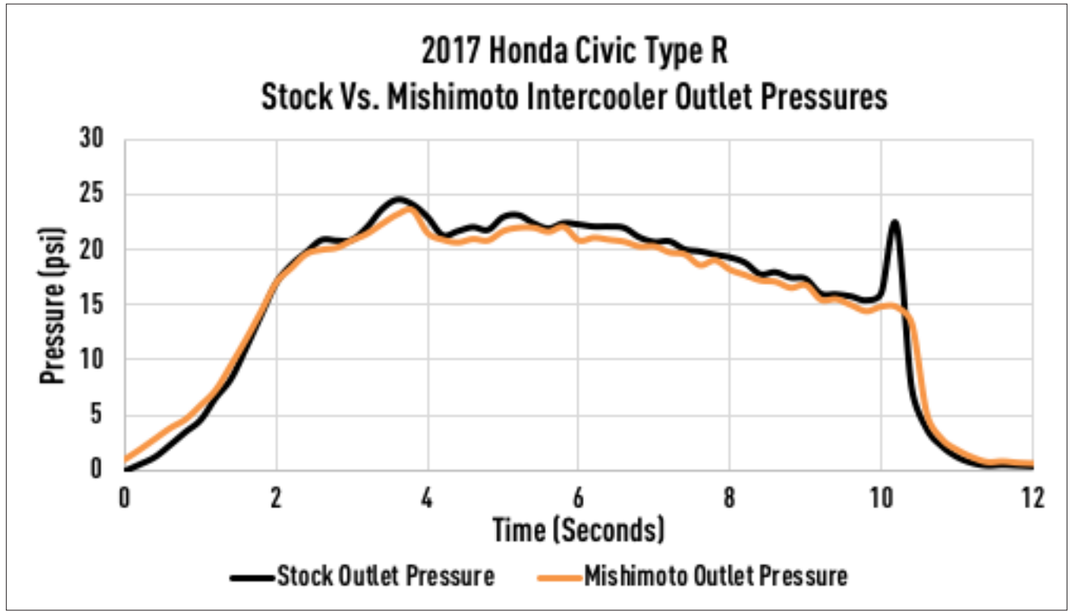

FIGURE 14: *The Mishimoto intercooler and piping resulted in an additional 1 psi of boost pressure drop compared to the stock intercooler and piping.*

As seen in Figure 14, the Mishimoto intercooler and piping follows the outlet pressure curve to within 1 psi of the stock intercooler and piping. This is well within an acceptable range and will not have any adverse effects on the intercooling system of the Civic Type R.

As a bonus to go along with the reduction in outlet temperatures, the Mishimoto intercooler and piping yielded max power gains of 10 hp and 10 ft-lbs 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.

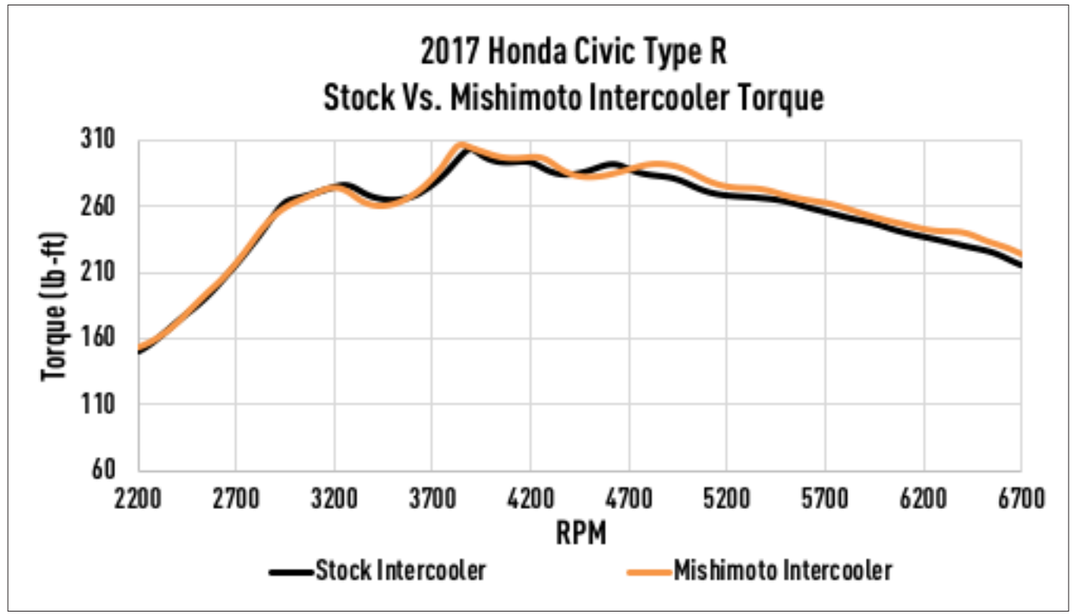

FIGURE 15: *The Mishimoto intercooler yielded a peak gain of 4 ft-lb and max gain of 10 ft-lb.*

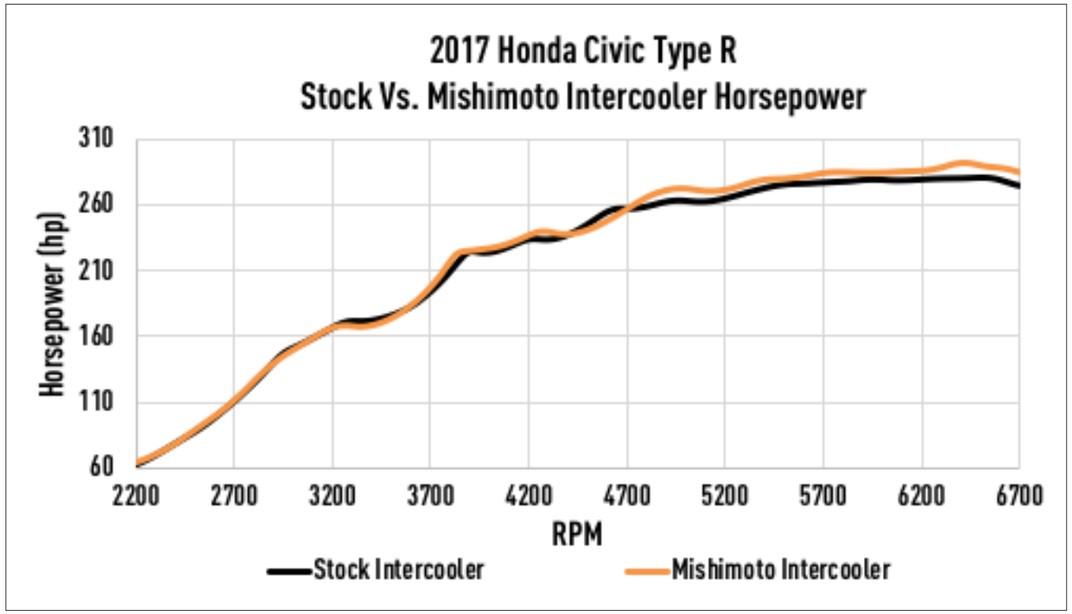

FIGURE 16: *The Mishimoto intercooler yielded a peak gain of 12 hp and max gain of 10 hp.*

FIGURE 17: *Mishimoto intercooler installed on the car.*

FIGURE 18: *Mishimoto intercooler 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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