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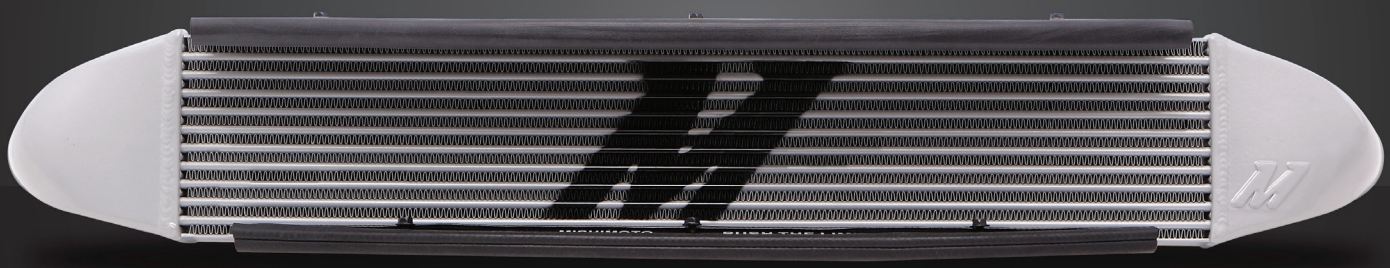

ENGINEERING REPORT

2014+ Ford Fiesta ST Performance Intercooler | SKU: MMINT-FIST-14

By Steve Wiley, *Mishimoto Engineer*

REPORT AT A GLANCE

- **Goal:** Design a direct-fit intercooler that keeps charge air temperatures and pressure drop across the core as low as possible.
- **Results:** The Mishimoto intercooler showed temperature drops of up to 26°F (14.5°C) when compared to the stock intercooler. This reduction was achieved with an overall pressure drop of less than 1 psi.
- **Conclusion:** The Mishimoto direct-fit intercooler is an excellent upgrade for Fiesta owners who want a well-balanced intercooler in terms of performance, fitment, and weight.

CONTENTS

DESIGN OBJECTIVES

The design requirements assigned to this project are as follows:

- Design a performance intercooler that reduces charge-air temperatures when compared to the stock cooler.
- Must be a direct fit with no cutting or permanent modification necessary.
- Intercooler should not show a significant increase in pressure drop when compared to stock.
- Added weight should be minimized as much as possible.

DESIGN AND FITMENT

We began the R&D process by evaluating the stock intercooler and finding potential room for improvement. The stock intercooler is a relatively hollow tube-and-fin design. After evaluating the internal construction of the core, it was evident that this unit was susceptible to heat-soak. The Mishimoto performance intercooler was designed to increase overall core volume and fin surface area while retaining a direct fitment.

As shown in Figures 1 and 2, the Mishimoto intercooler increases core volume by 51% and fin surface area by 226% when compared to stock

The Fiesta ST is a light, nimble vehicle, and additional weight is a concern for many owners. The Mishimoto intercooler was tested with both bar-and-plate and tube-and-fin cores. We found that the tube-and-fin core performed as well as the bar-and-plate design while offering a 5.5 pound weight reduction. Given the weight reduction and almost identical temperature drop, a tube-and-fin core was chosen for the final design.

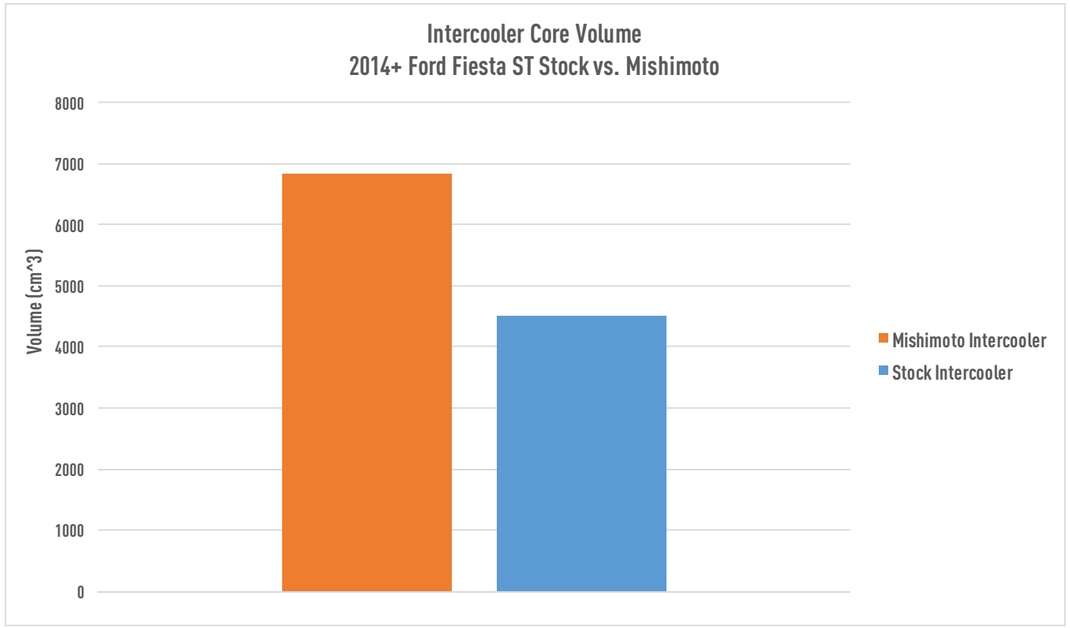

FIGURE 1: *The Mishimoto intercooler core is 51% larger than stock while maintaining a factory fit.*

MORE INFORMATION ON THE R&D PROCESS FOR THE INTAKE CAN BE FOUND ON THE MISHIMOTO ENGINEERING BLOG.

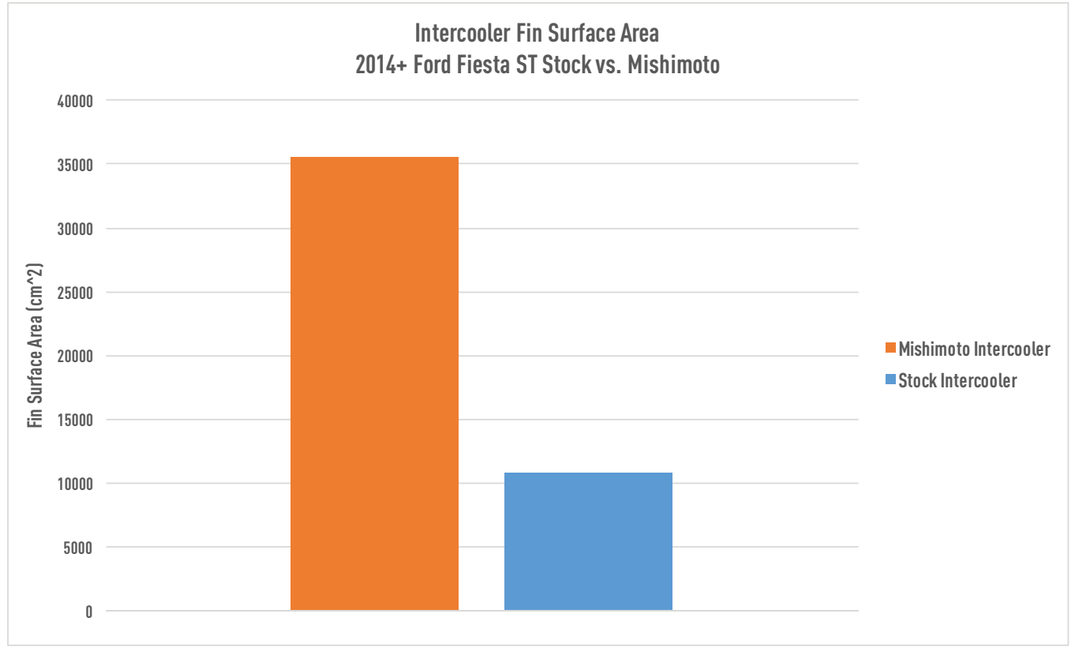

FIGURE 2: *By reducing fin height and pitch, the surface area was increased by 226% compared to the stock core.*

PERFORMANCE TESTING

A completely stock 2014 Fiesta ST was used for testing. The ambient temperature on the day of testing was approximately 60°F (15.5°C) with 20% humidity. To test the performance increases of the intercooler, a Dynapack™ dynamometer was used to apply a constant and repeatable load on the Fiesta ST.

FIGURE 3: *A Dynapack™ dynamometer was used for vehicle testing.*

To test the performance gains of the Mishimoto intercooler, the Fiesta ST was bolted to the Dynapack, and baseline pulls were made on the completely stock car. The same test was performed with multiple Mishimoto intercoolers installed. Fourth-gear pulls showed how each core performed in terms of pressure drop, but the intercoolers did not get hot enough to show any appreciable differences in outlet temperatures. To compensate for this, the Fiesta was run at full load for 15 seconds at 4,000 rpm. This allowed each core to heat-soak, which more closely simulated a track-day condition.

From testing it was clear that the Mishimoto cores outperformed the stock intercooler in terms of temperature drop, but they showed a noticeable increase in pressure drop. In an effort to develop the most superior product possible, we chose to test two more cores to try to achieve the same temperature drop while decreasing pressure drop. The results for temperature drops and pressure drops from both rounds of testing can be seen in Figures 4–6.

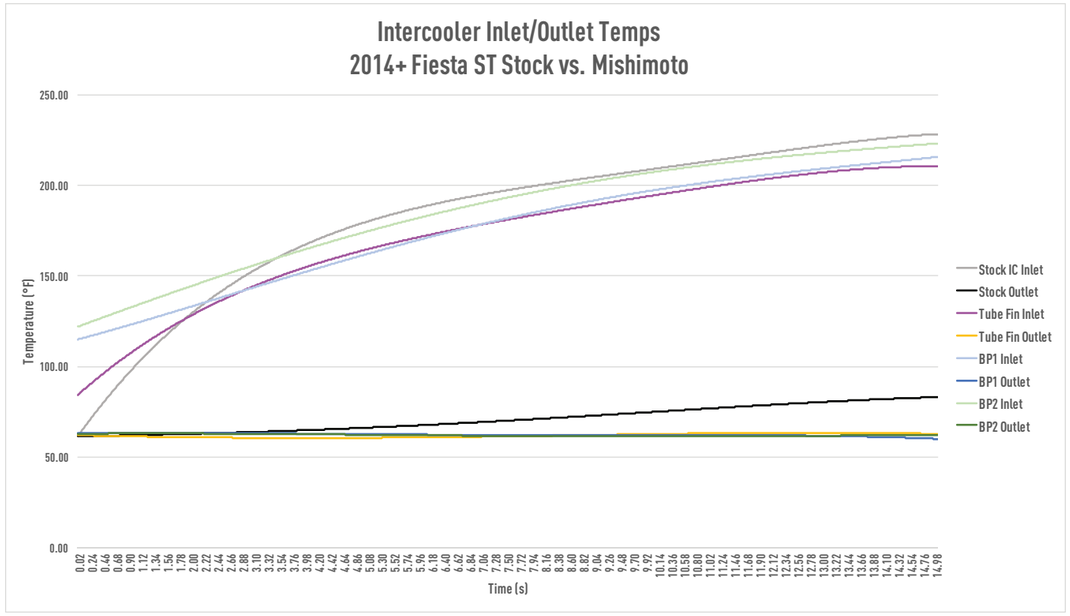

FIGURE 4: *The first three intercooler cores sampled showed significant temperature drops when compared to stock; however, pressure drop figures still left room for improvement.*

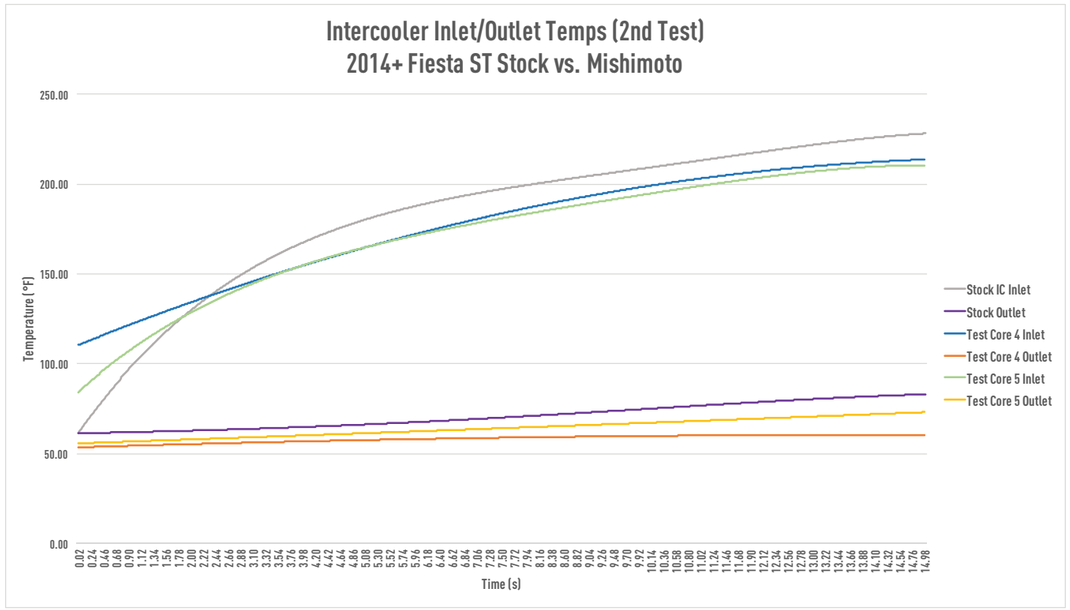

FIGURE 5: *The fourth core tested showed temperature drops similar to the first three. The fifth core was much less dense internally and therefore showed signs of heat-soak similar to the stock core (though still slightly better).*

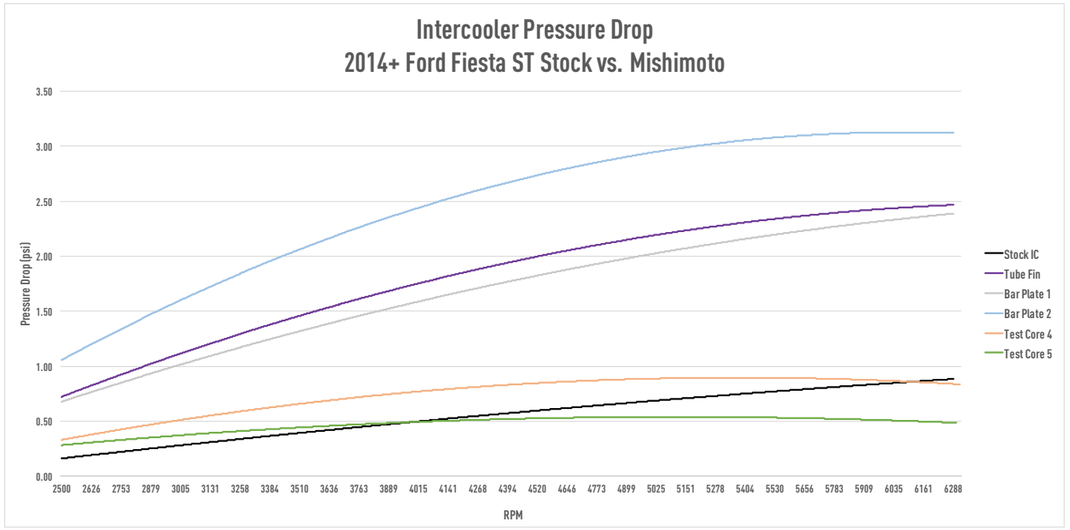

FIGURE 6: *Pressure drop from all five cores compared to stock. With dense internal fins, the first three cores showed a significant increase in pressure loss compared to stock (black).*

The chosen core for the Mishimoto direct-fit intercooler was test core number 4 (orange).

This configuration showed temperature drops of up to 26°F (14.5°C) compared to the stock intercooler, without showing any signs of heat-soak throughout the entire testing process. This was achieved with an increase of less than 0.4 psi (compared to stock) and an overall pressure drop of less than 1 psi.

These are excellent results for a direct-fit intercooler.

As is the case with many intercoolers, power levels did not show any appreciable gains on a completely stock tune. 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. If an aftermarket tune is being 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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