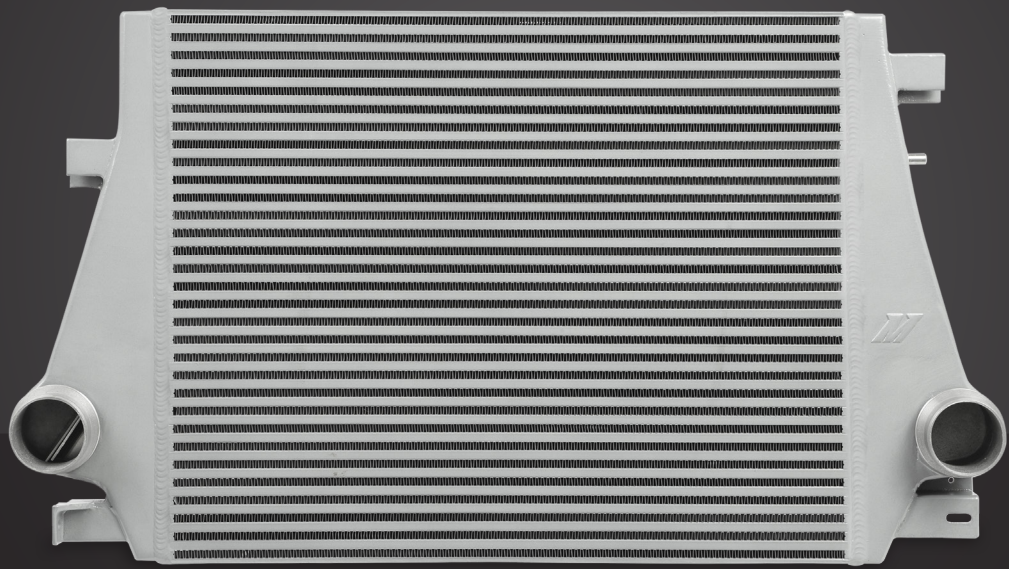

ENGINEERING REPORT

2016+ Camaro 2.0T/2013+ Cadillac ATS 2.0T Intercooler | SKU: MMINT-CAM4-16

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 61°F (34°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 Camaro 2.0T owners who want a well-balanced intercooler that will resist heat-soak, preserve power levels, and significantly reduce charge-air temperatures.

CONTENTS

PG 1 — DESIGN OBJECTIVES
PG 1 — DESIGN AND FITMENTS
PG 2 — PERFORMANCE TESTING

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

DESIGN AND FITMENTS

We began the R&D process by evaluating the stock intercooler and finding potential room for improvement. The stock intercooler is a relatively thin and hollow tube-and-fin design. After evaluating the internal construction of the core, it was evident that this unit was likely susceptible to heat-soak. The Mishimoto performance intercooler was designed to increase overall core volume and fin surface area while retaining a direct fitment. The Mishimoto intercooler increases overall core volume by 78% and external fin surface area by 239% when compared to stock, as shown in Figures 1 and 2.

During the initial design phase of the intercooler, a good deal of attention was focused on utilizing the entire core as air flowed internally through it. The inlet and outlet ports are mounted low on the core, and CFD analysis showed that much of the air preferred to travel through the lower channels. To take advantage of the upper portion of the core, various internal diverters were modeled and simulated until reaching a well-balanced design. The result is shown below in Figure 3.

More information on the R&D process for the intercooler can be found on the Mishimoto engineering blog:

MISHIMOTO ENGINEERING BLOG

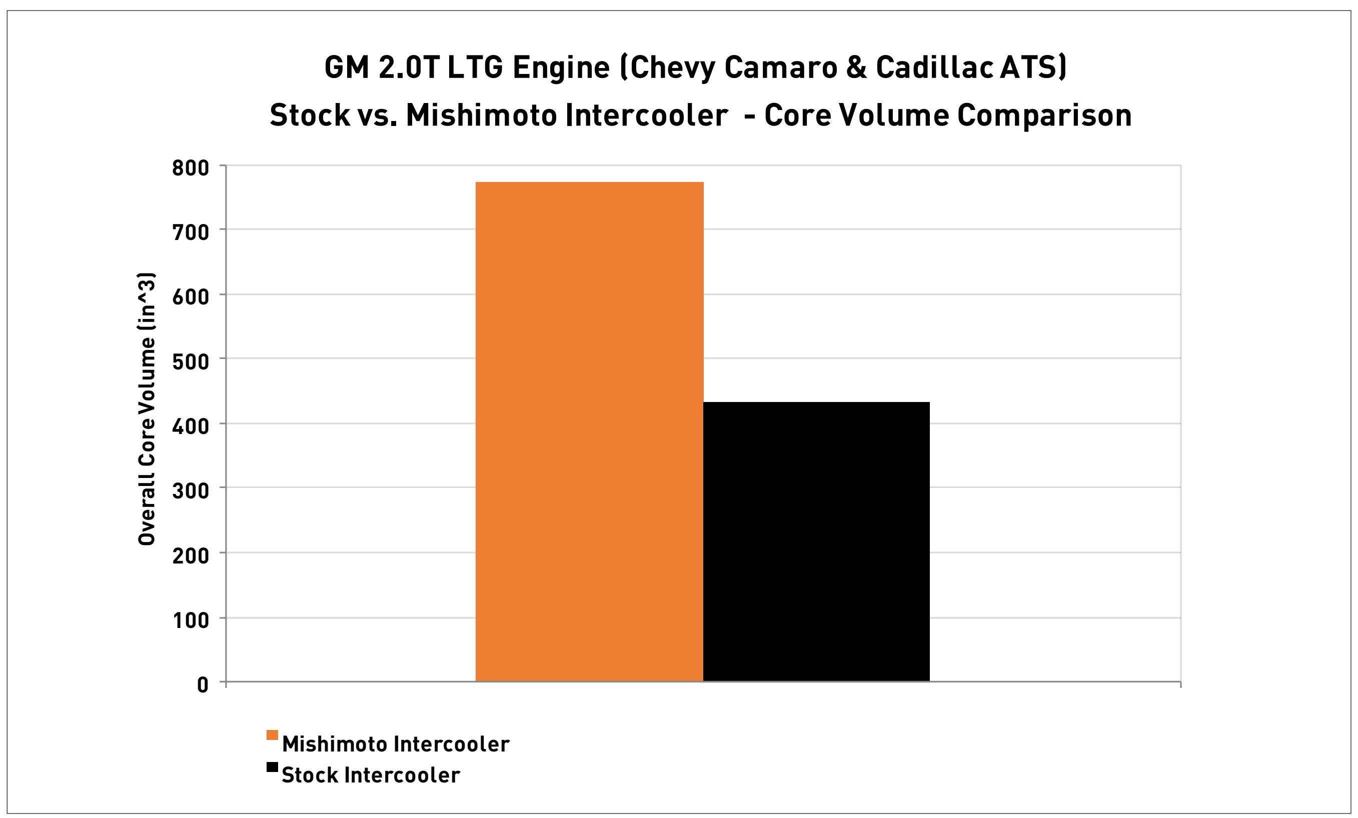

FIGURE 1: *The Mishimoto intercooler increases overall core size by 78% when compared to stock*

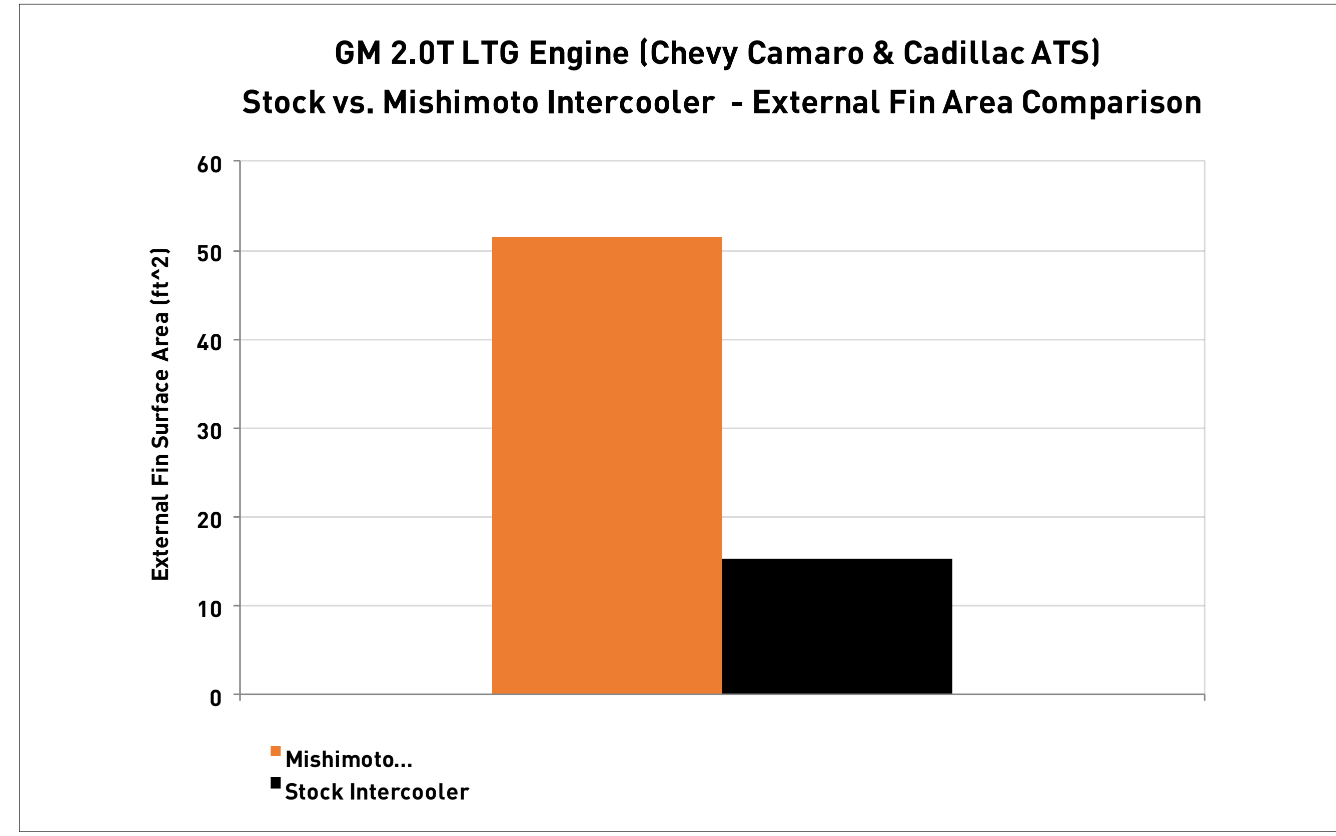

FIGURE 2: *External fin surface area is increased by 239% to improve heat rejection capabilities of the intercooler.*

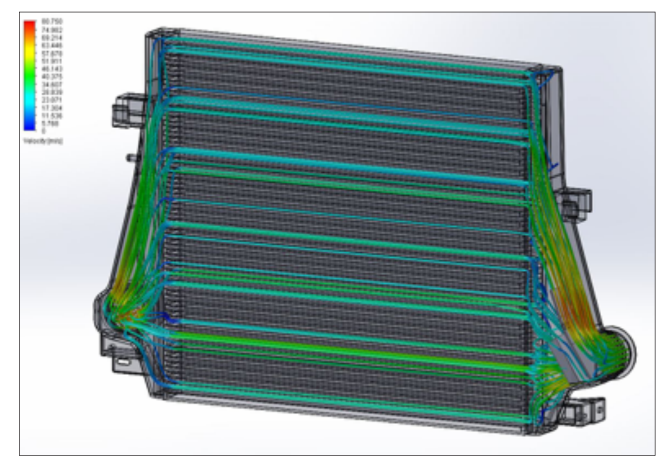

FIGURE 3: *Air diverters are added to the inlet end tank of the Mishimoto intercooler to ensure the entire core is utilized.*

PERFORMANCE TESTING

A completely stock 2016 Chevy Camaro 2.0T was used for testing. The ambient temperature on the day of testing was approximately 68°F (20°C) with 50% humidity. To test the performance increases of the intercooler, a Dynapack™ dynamometer was used to apply a constant and repeatable load on the Camaro.

The Camaro was set on the Dynapacks, and baseline pulls were made on the stock intercooler. To simulate harsh on-road conditions, the car was run at wide open throttle, up to 6500 RPM, five times in a row and was cooled for one minute in between each pull. This test was then repeated on two different Mishimoto intercooler cores. The testing results below show the outlet temperature and pressure drop comparison of the stock intercooler to the chosen Mishimoto intercooler.

FIGURE 4: *A Dynapack dynamometer was used to apply a repeatable load on the Camaro during testing.*

As shown in Figure 5, the chosen Mishimoto intercooler had temperature drops of up to 25°F (14°C) compared to the stock intercooler, while demonstrating minimal signs of heat-soak throughout the entire testing process. This was achieved with an overall pressure drop of less than 1 psi.

These are excellent results for a direct-fit intercooler. The results from pressure drop testing can be seen in Figure 6.

Once redline testing was completed, a load test was performed to heat-soak the stock and Mishimoto intercoolers as aggressively as possible. The car was held at full throttle for ten seconds while the Dynapacks held the engine at 4,000 RPM. As shown in Figure 7, the stock intercooler heat-soaks quickly and outlet temperatures climb dramatically, while the Mishimoto intercooler shows no signs of increasing outlet temperatures.

The chosen Mishimoto intercooler showed temperature drops of up to 61°F (34°C) compared to the stock intercooler, while showing no signs of heat-soak throughout the entire testing process.

These are excellent results for a direct-fit 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 if it effectively prevents charge-air temperatures from increasing.

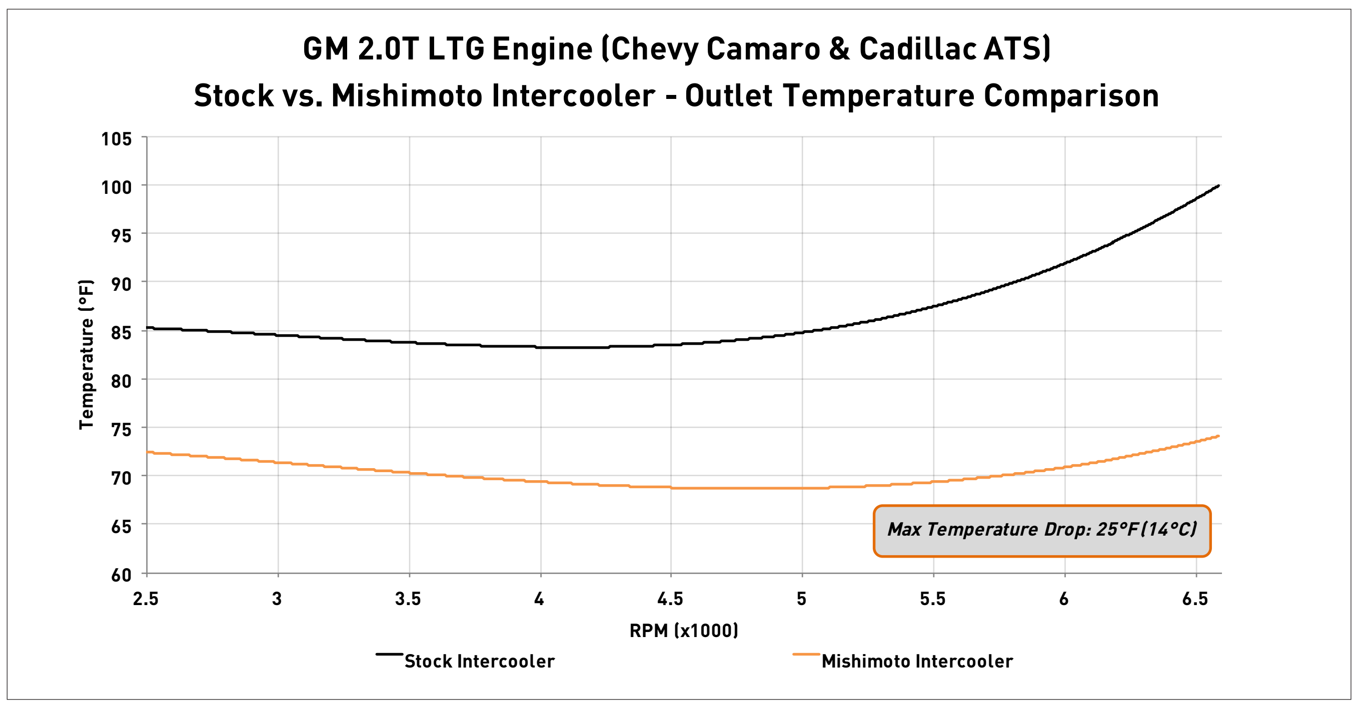

FIGURE 5: *The outlet temperatures of the stock and Mishimoto intercoolers are shown after the fifth consecutive dyno pull. It's clear that the Mishimoto intercooler is superior at resisting heat-soak.*

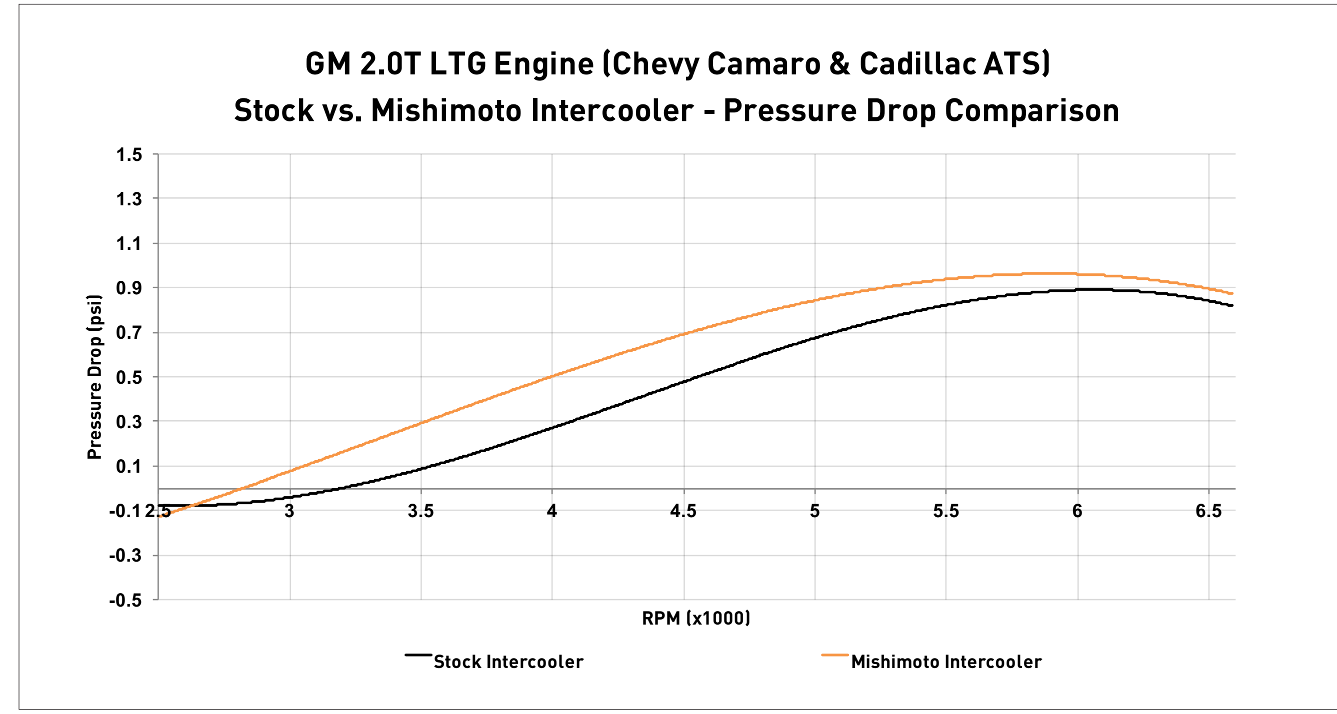

FIGURE 6: *The Mishimoto intercooler showed an overall pressure drop of less than 1 psi, which is well within the desirable range.*

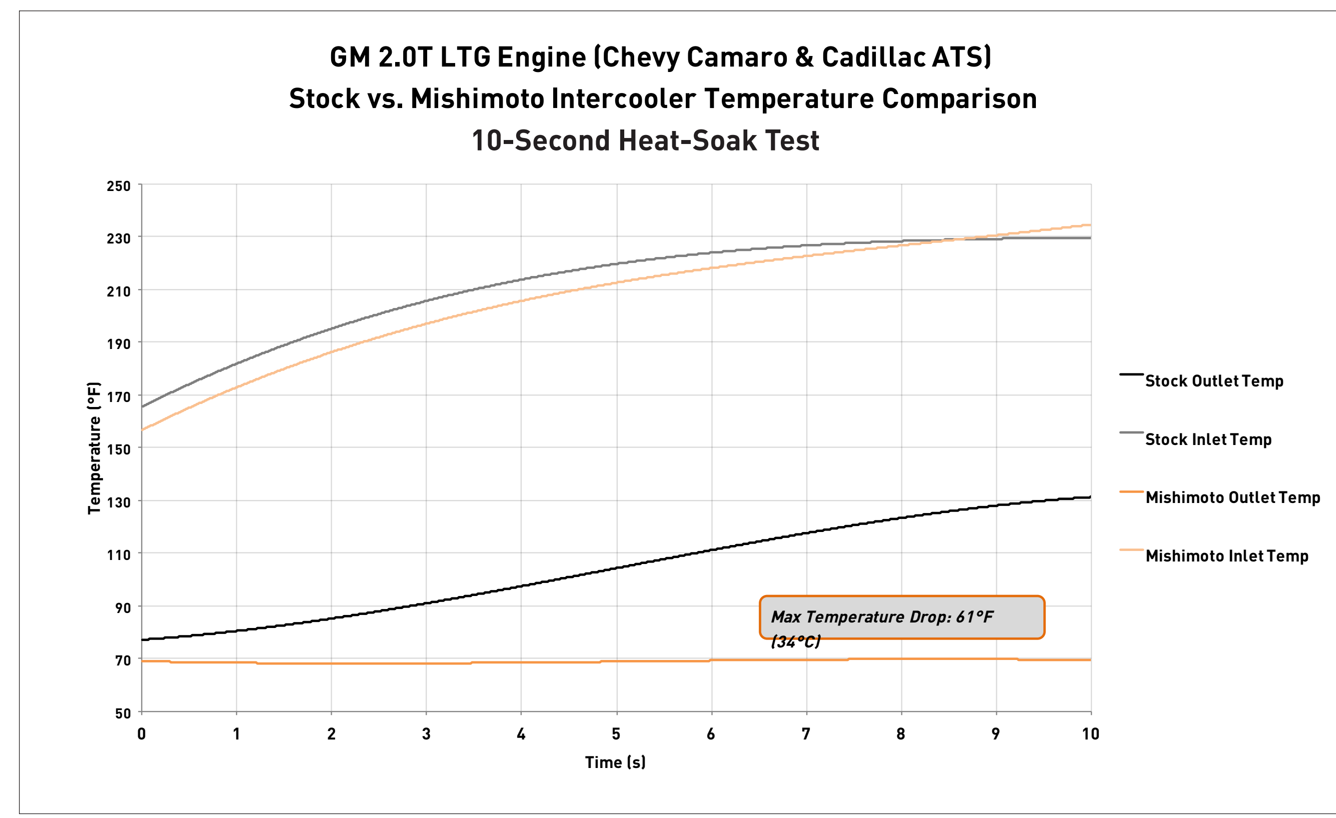

FIGURE 7: *Both intercoolers were held at full throttle for ten seconds to heat soak each core as much as possible.*

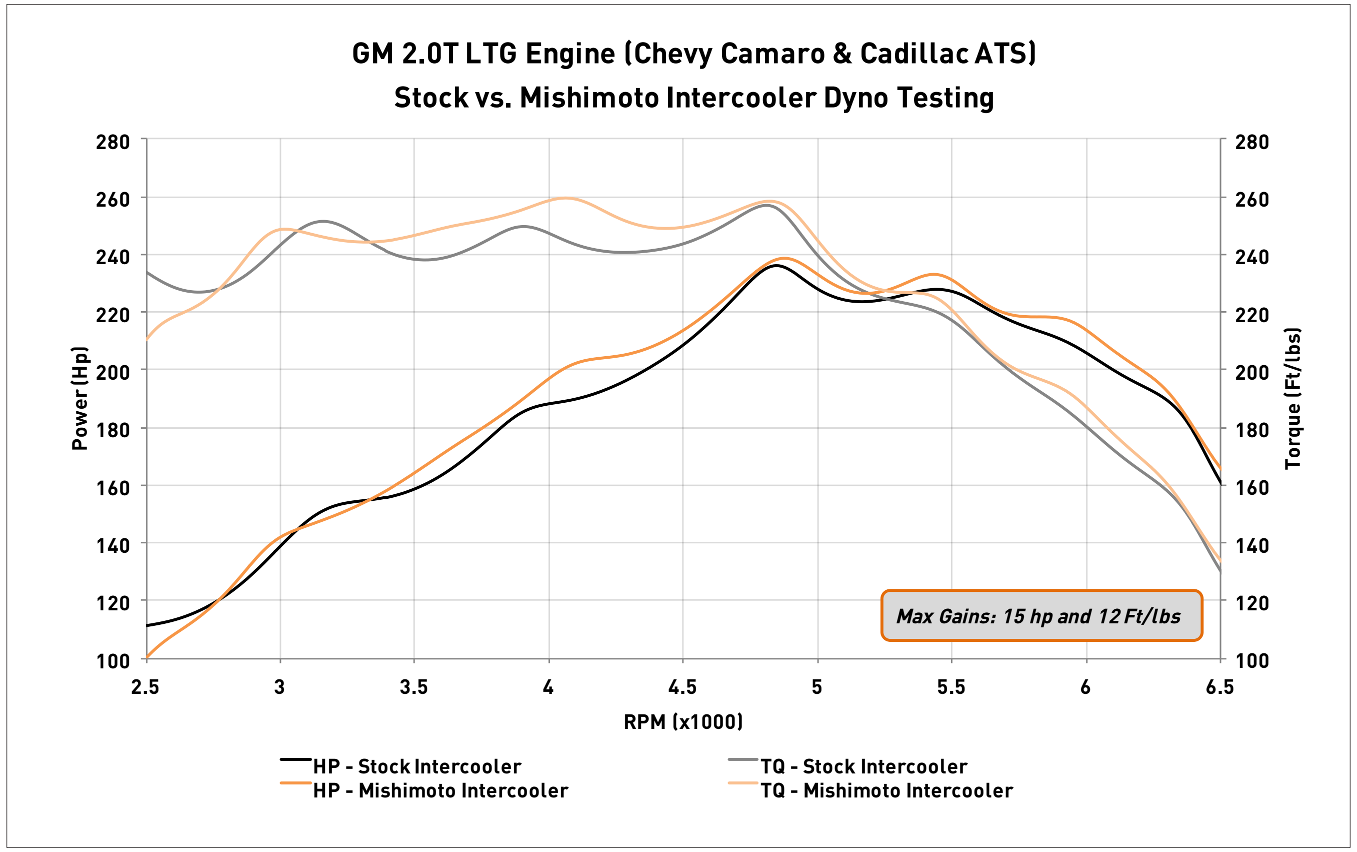

FIGURE 8: *The Mishimoto intercooler showed power gains over stock due to an increase in internal flow volume and lower outlet charge-air temperatures.*

As seen above in Figure 8, the Mishimoto intercooler showed power gains of up to 15 hp and torque gains of up to 12 ft-lb. This is likely due to a combination of lower charge-air temperatures and an increase in internal volume.

The Mishimoto intercooler is an excellent upgrade for all Camaro 2.0T owners who are driving in hot climates, have a performance tune loaded, or want power levels to remain consistent under hard driving conditions.

Steve Wiley
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