MISHIMOTO

ENGINEERING REPORT

2020+ Toyota GR Supra 3.0L Performance Heat Exchanger | SKU: MMHE-SUP-20

By Jason Wettig, *Mishimoto Engineer*

REPORT AT A GLANCE

- **Goal:** Create a heat exchanger that outperforms the stock units. The Mishimoto parts should install directly into the Supra with minimal cutting and modification required.
- **Results:** The Mishimoto heat exchanger dropped Intake Air Temperatures (IAT) on a stock car by 7 degrees. Increased Core Volume by 31% and external fin area by 48% over the stock unit.
- **Conclusion:** The Mishimoto heat exchanger performed better than the stock unit and provided better cooling to tuned vehicles that generate more heat. It is a valuable upgrade for Supra owners who drive their vehicles on tracks or in hot climates.

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DESIGN OBJECTIVES

The design requirements assigned to this project are as follows:

- Create a heat exchanger that outperforms the stock unit.
- Must be a direct fit, with minimal cutting required.

DESIGN AND FITMENT

The R&D process began by evaluating the stock system and understanding how the team who developed the Supra chose to package the cooling stack. We needed to understand the layout and available space before the core could be increased in size. A good understanding of how the stock system works was also required. There are several systems tied into the heat exchanger and a few electric pumps that move coolant through the system.

The heat exchanger was designed to maximize size while not restricting airflow to the radiator. For this, a 42mm thick core was used. A dense fin was also used to help ensure greater heat rejection potential. The ability to re-use the stock lower stone guard was added to improve the tubes' protection on the heat exchanger.

The stock supra Heat exchanger was quite large from a frontal surface are standpoint. So, to get the maximum amount of cooling out of this unit, the core had to be thicker than stock. Some trimming of the surrounding housing is required, and provisions have been made to accommodate the transmission cooler.

The Mishimoto heat exchanger also saw a core volume increase of 31% when compared to stock. Figure 2 shows this comparison.

FIGURE 1: *Mishimoto production sample heat exchanger.*

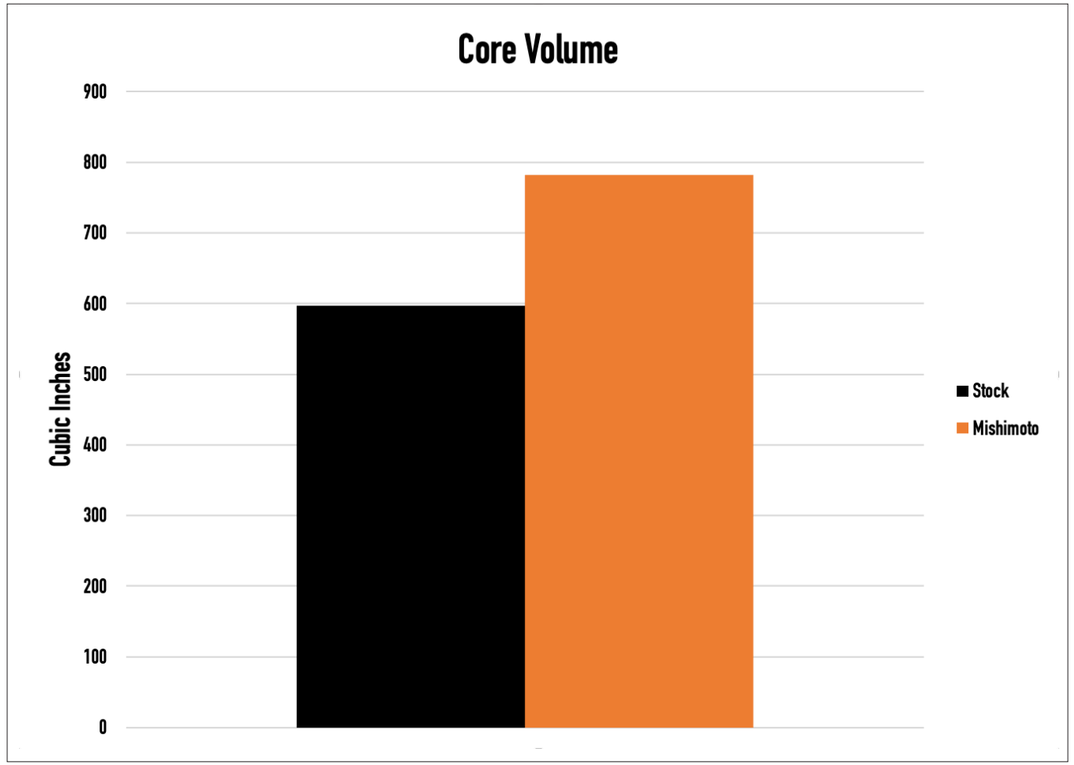

FIGURE 2: *The Mishimoto heat exchanger has a larger core volume; this promotes better heat transfer.*

The Mishimoto Heat exchanger increases the fin surface area by 48% when compared to stock. With the thicker core and more rows, a larger amount of fin surface area can be created. Figure 3 displays this difference between the stock and Mishimoto heat exchanger.

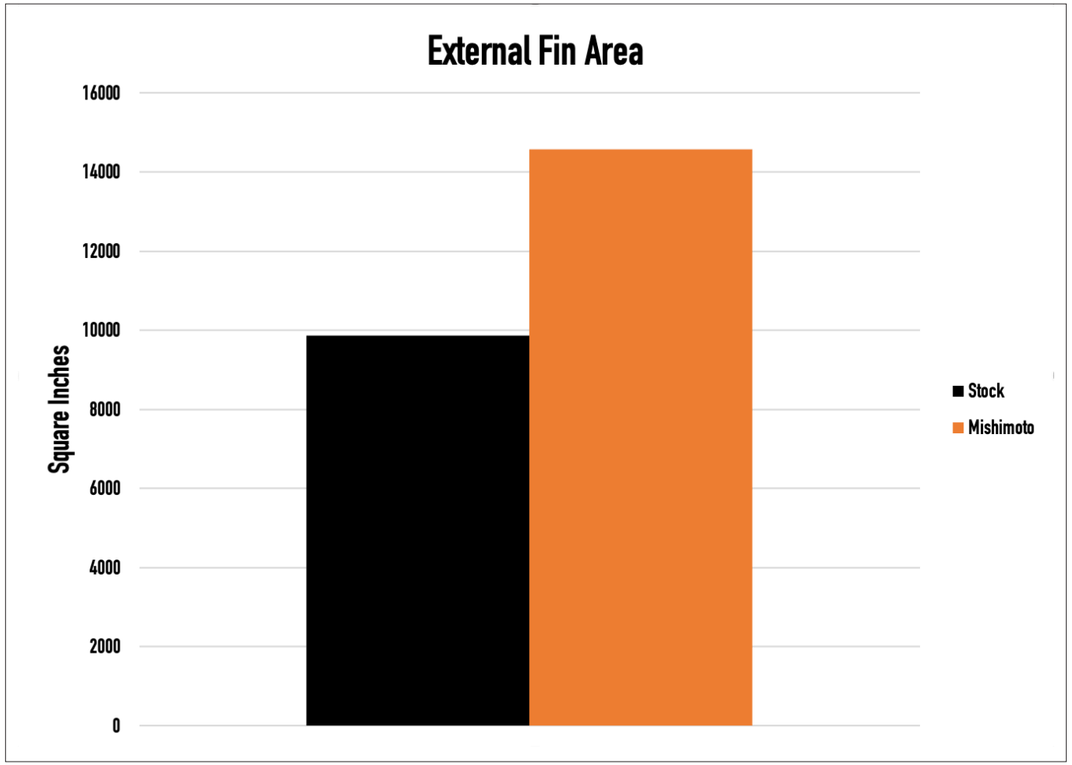

FIGURE 3: *The Mishimoto Heat Exchanger features an increase in fin surface area, which promotes greater heat transfer.*

PERFORMANCE TESTING

To perform the testing and put the car through the harshest conditions, the Supra was bolted onto our Dynapack system. The car was run in a high load situation with 6 back to back consecutive runs completed. This heat soak testing allowed us to overtax the stock secondary cooling system. Sensors were placed through the cooling system, and a standalone computer monitored their temperatures. A Bluetooth scanner logged the engine manifold temperatures. This testing showed that the Mishimoto core over the 6 runs helped keep the air intake temperatures lower by lowering the coolant temperature leaving the Heat Exchanger. Figure 4 shows the temperature in the cooling system inlet vs outlet for both stock and Mishimoto. Figure 5 shows the intake air temperature Stock vs Mishimoto over 10 runs.

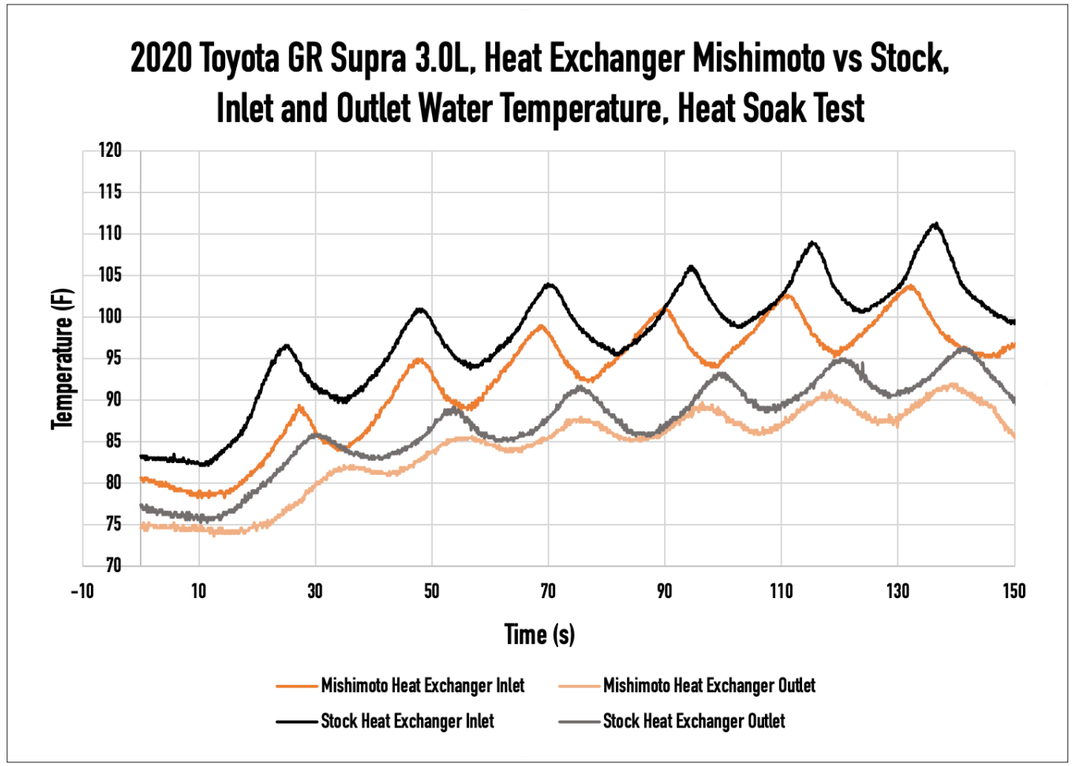

FIGURE 4: *The Mishimoto vs the stock Heat Exchanger. This shows how the Mishimoto Unit kept the outlet and global coolant temperatures lower.*

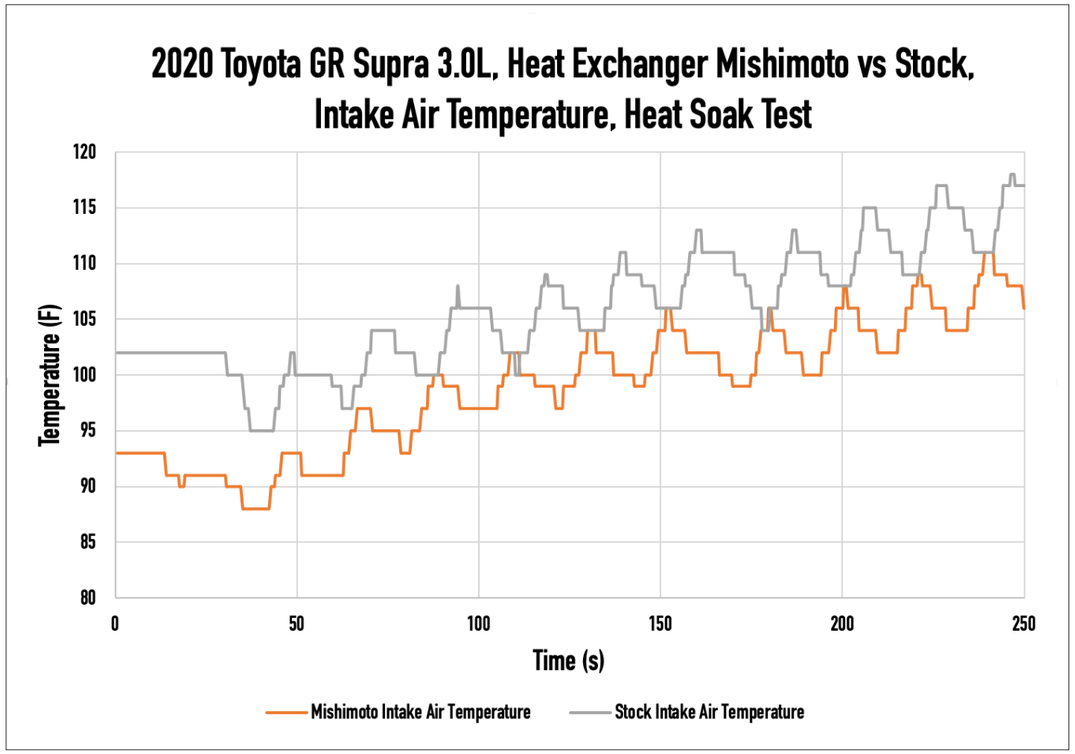

FIGURE 5: *The Mishimoto Heat Exchanger kept the IAT lower than the stock unit, which helped fight the effects of heat soak on an engine by keeping the charge air cooler when entering the engine.*

CONCLUSION

The complete Mishimoto suite of products helps the Supra platform get the most out of this driving machine. The increase in size and decrease in coolant and intake air temperatures allows drivers to get more out of this vehicle under harsher conditions. The ability to prevent the onset of heat soak with the larger heat exchanger will allow for more potential power when tuning the vehicle. This also translates into more repeatable power on the track when conditions are extremely harsh.

Testing done by

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