

ENGINEERING REPORT

2008+ SUBARU WRX STI PERFORMANCE TOP-MOUNT INTERCOOLER KIT | SKU: MMTMIC-STI-08

By Kevin McCardle, *Mishimoto Product Engineer*

REPORT AT A GLANCE

- **Goal:** Create a direct-fit top-mount intercooler that outperforms the stock.
- **Results:** The increased efficiency of the Mishimoto intercooler allows for more aggressive tuning, which leads to more power. Mishimoto recommends this intercooler for vehicles rated at 275–400 whp, and with a maximum rating of 500 whp.
- **Conclusion:** The on-road testing is proof that this intercooler is superior to the stock unit. The top-mounted stock intercooler for the 2008+ STI has improved over the previous models; however, the Mishimoto intercooler still outperformed it.

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TEST VEHICLE

Test Vehicle: 2010 Subaru STI
Modifications: Stock
Cooling System Upgrades: Mishimoto radiator, 12" fans, and aluminum fan shroud.
Testing Conditions: Temperature range 62°F–65°F and 30% humidity



FIGURE 1: Test vehicle

APPARATUS

For temperature and pressure monitoring, Mishimoto chose the PLX sensor modules driven by the Kiwi WiFi plus iMFD. This is a wireless system from the sensor modules to an iPad or laptop computer. The software used was the Palmer Performance Scan XL pro, which has full data logging capabilities. Inlet temperature and pressure sensors were installed in the beginning of the Y-pipe (Figure 2). Outlet temperature and pressure sensors were installed at the outlet of the intercooler (Figure 3).



FIGURE 2: Mounting locations for temperature and pressure sensors, which read approximately 10 times per second.



FIGURE 3: Mounting locations for temperature and pressure sensors, which read approximately 10 times per second

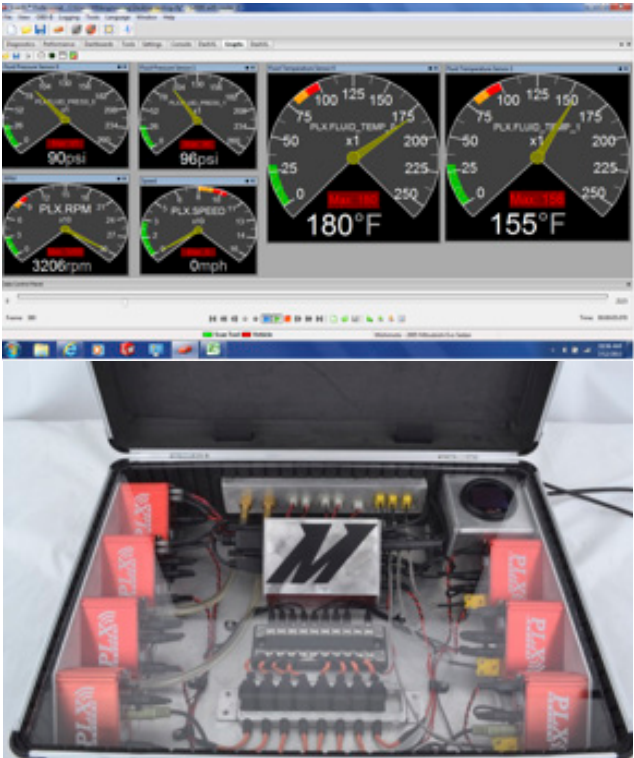


FIGURE 4: PLX sensor modules were used to monitor engine pyrometers

BACKGROUND

The stock top-mounted intercooler for the 2008–2014 STI has been improved over the previous models. Improvements of the end tank designs and overall size of the core make this intercooler perform better. The Y-pipe has also improved significantly. Mishimoto found after some CFD modeling that the Y-pipe on 2008–2014 models actually split the charged air 50/50. This is why Mishimoto chose to keep the stock Y-pipe and only change the intercooler. A couple of flaws are the lack of even air distribution entering the core and overall size of the core. Mishimoto addressed these two issues by adding angled air diverters that are casted into the top inlets of the end tank. These diverters help air spread out to the edges of the core. Mishimoto also made the core much larger by adding more length and depth. Below are some comparisons of the Mishimoto and stock core.

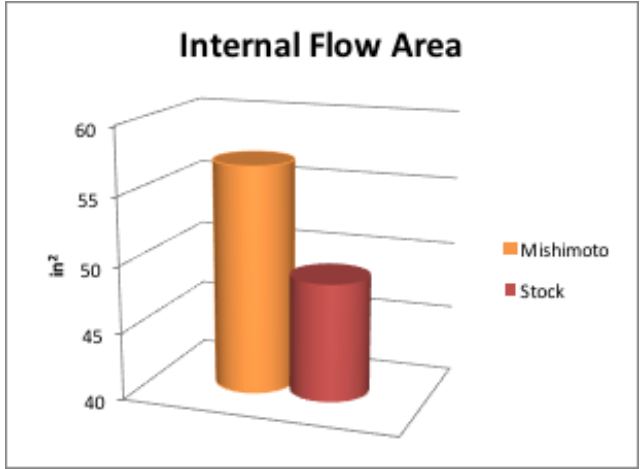


FIGURE 5: Mishimoto intercooler shows a 15% increase in internal flow area.

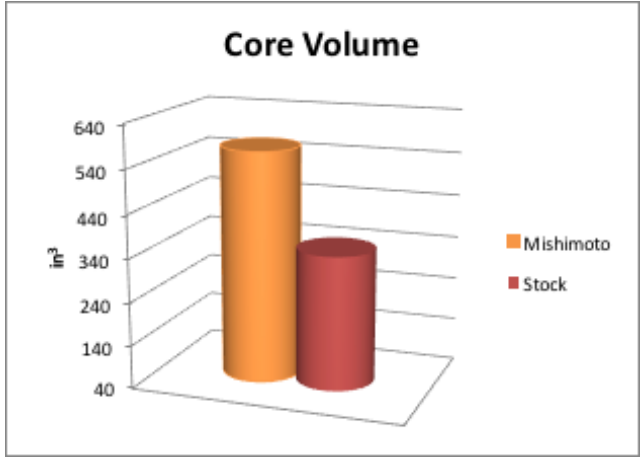


FIGURE 6: Mishimoto intercooler shows a 39% increase in core volume.

DYNO TESTING

Mishimoto designed three different intercooler cores for prototype testing. Each core had a different pressure tube geometry, as well as different fin styles. The best performing intercooler is represented in this report and will be used in production. The Subaru was strapped to the dyno once, and two tests were conducted, swapping the intercoolers in-between. All testing was done with the same testing conditions, so the only variable was the intercooler. Each intercooler received a warm-up run and four to five additional runs (or until we had an average of three consistent runs). A three-minute break was given between runs to allow the car to properly cool down. The averages of those three runs are represented in this report. A blower fan was placed directly on the intercooler face where it blew air at approximately 40 mph to about 50% of each core. No additional tuning or other modifications were made to the car.

DYNO TESTING CONCLUSIONS

Mishimoto’s engineers were pleased with the increase in power that the Subaru made. The outlet temperature was not quite the improvement that we wanted, but that might have been due to the insufficient airflow provided to the intercooler. Mishimoto engineers decided to take the Subaru out on the road to gather some real-world temperature data and to determine if the Mishimoto intercooler would outperform the stock.

ROAD TESTING

Testing was conducted on a closed road course. Each run was done in 1st to 3rd gear at 100% throttle.

CONCLUSION

The on-road testing is proof that this intercooler is superior to the stock unit. The top-mounted stock intercooler for the 2008+ WRX STI has improved over the previous models; however, the Mishimoto intercooler still outperformed it. The increased efficiency of the Mishimoto intercooler allows for more aggressive tuning, which leads to more power. Mishimoto recommends this intercooler for vehicles rated at 275–400 whp, and with a maximum rating of 500 whp.

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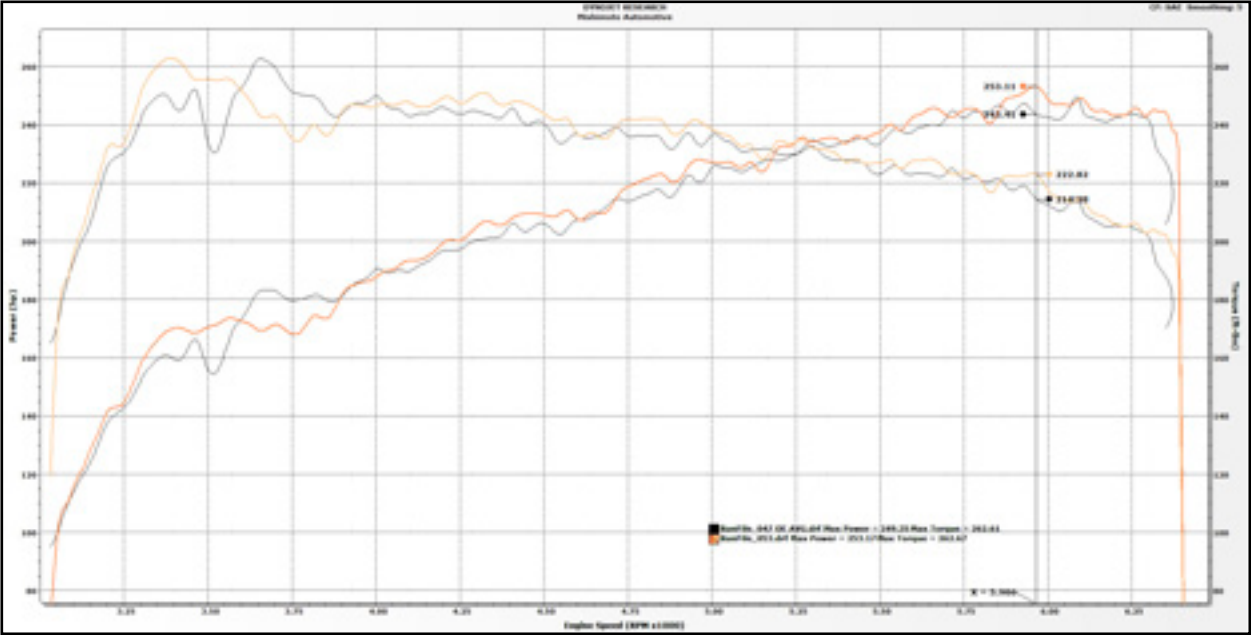


FIGURE 7: Mishimoto intercooler (orange line) gained 4–5 whp on average throughout the run.

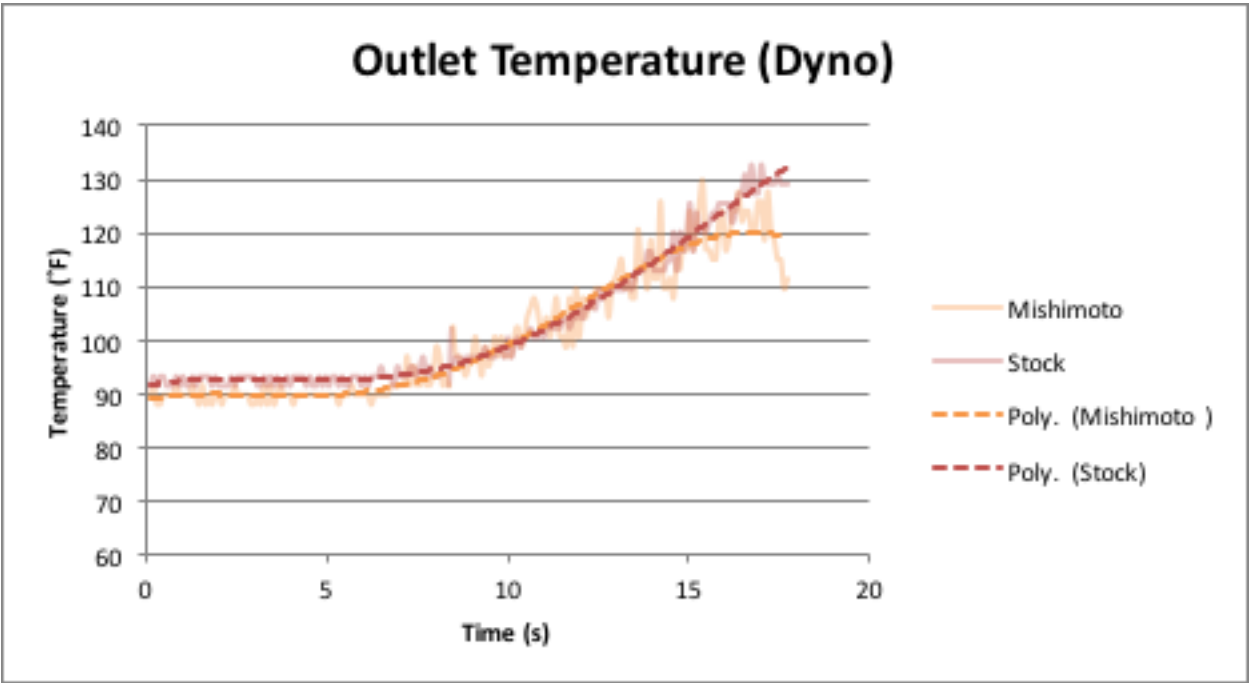


FIGURE 8: Mishimoto intercooler showed a lower outlet temperature toward the end of the run

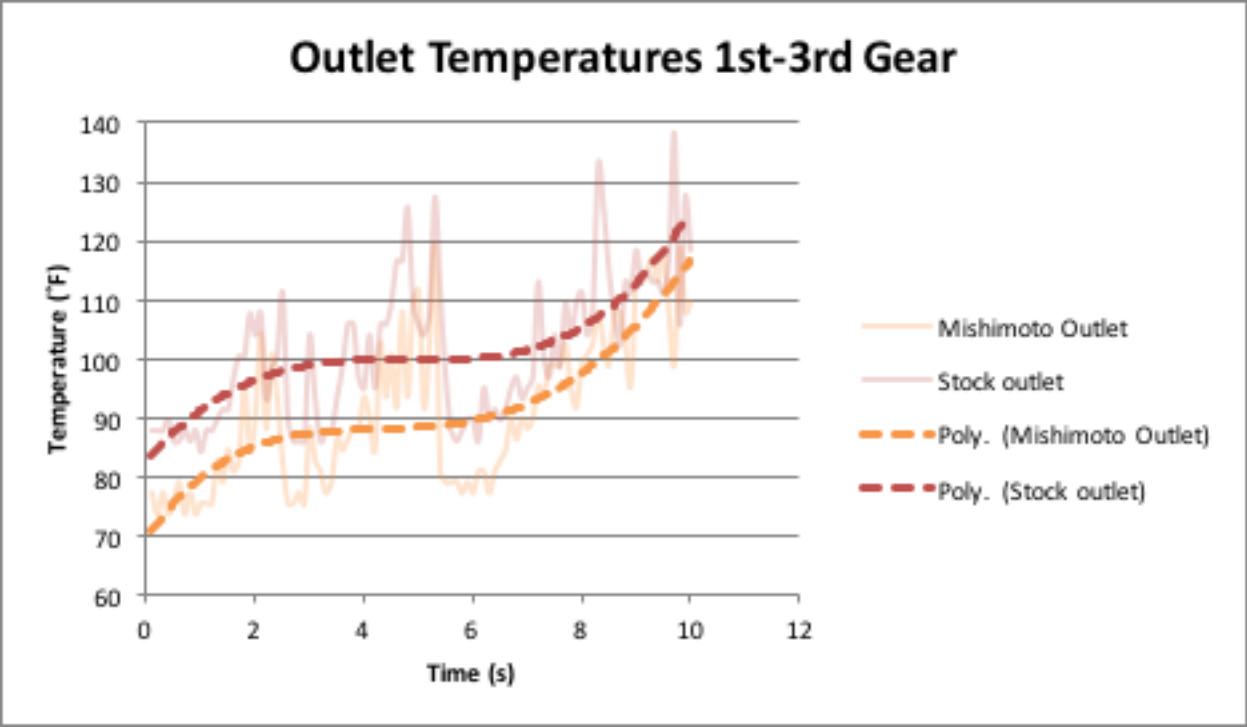


FIGURE 9: Mishimoto intercooler showed an average of 10°F drop in temperature over stock.

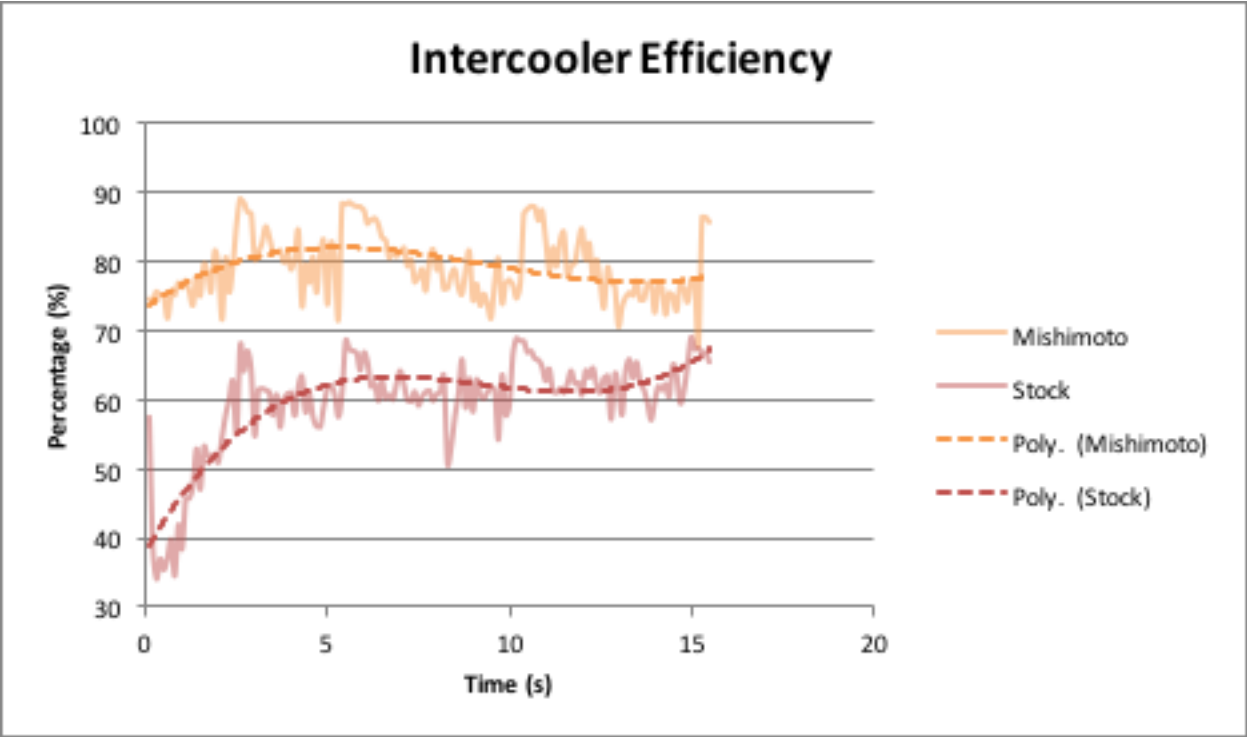


FIGURE 10: Mishimoto intercooler shows a 15% increase in efficiency.

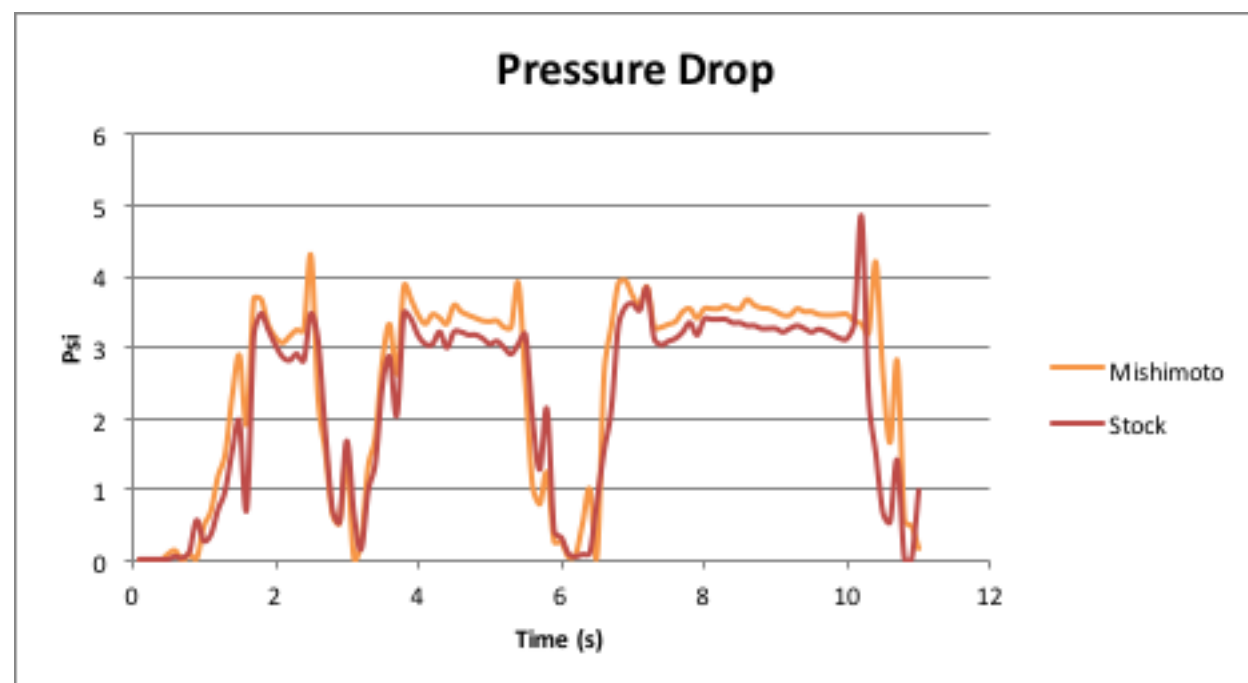


FIGURE 11: Comparison of the stock intercooler to the Mishimoto intercooler.

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