MISHIMOTO

ENGINEERING REPORT

2016+ Infiniti Q50/Q60 Performance Heat Exchanger | SKU: MMHE-Q50-16

By Ye Liu, *Mishimoto Product Engineer*

REPORT AT A GLANCE

- **Goal:** Create a direct-fit heat exchanger for the water-to-air intercooler system that outperforms the stock heat exchanger.
- **Results:** Compared to the stock heat exchanger, the Mishimoto heat exchanger reduced outlet temperature by 21°F during heat soak testing and 18°F during load testing.
- **Conclusion:** The Mishimoto heat exchanger is a well-rounded upgrade for Q50 owners seeking to maximize performance while preserving a clean, OEM-like fitment.

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DESIGN OBJECTIVES

The design requirements assigned to this project are as follows:

- Create a heat exchanger that outperforms the stock counterpart in cooling capacity
- A direct-fit design with no permanent modification required for installation
- Maximize the heat exchanger's core volume
- Optimize inlet and outlet port locations to ensure proper air bleeding

DESIGN AND FITMENT

The Infiniti Q50 engine uses a water-cooled charge air cooler (CAC). The CAC charging system has an independent cooling water circuit and circulates coolant from charge air cooler to the CAC heat exchanger by using electric water pumps. The high pressure Red Sport 3.0T model utilizes two water pumps in the CAC system where 2.0T model Q50 has a single electric water pump.

The stock heat exchanger core measures at 500 mm x 134 mm x 15 mm. After evaluation of available design space, we chose an oversized core dimension of 525 mm x 313 mm x 22 mm. At a significant 260% core volume gain, the Mishimoto heat exchanger increased coolant capacity over the stock cooler by approximately 0.7 qt.

Aside from being significantly larger than the stock heat exchanger, the new design has additional features for a better installation experience. The inlet port is designed as a threaded fitting, which reduces the profile of the cooler to reduce the risks of damaging the condenser fin during installation, as the fitment can be very tight in this area. A CNC-machined bleeder screw is located on top of the driver-side end tank and can be accessed without removing the front bumper. Please note that Mishimoto recommends using an air-lift tool to refill the CAC cooling system, in which case you do not need to use this bleeder.

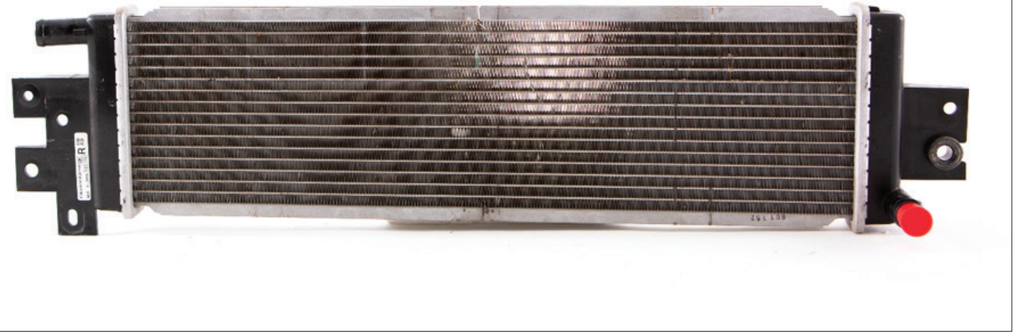

FIGURE 1: *Stock CAC heat exchanger*

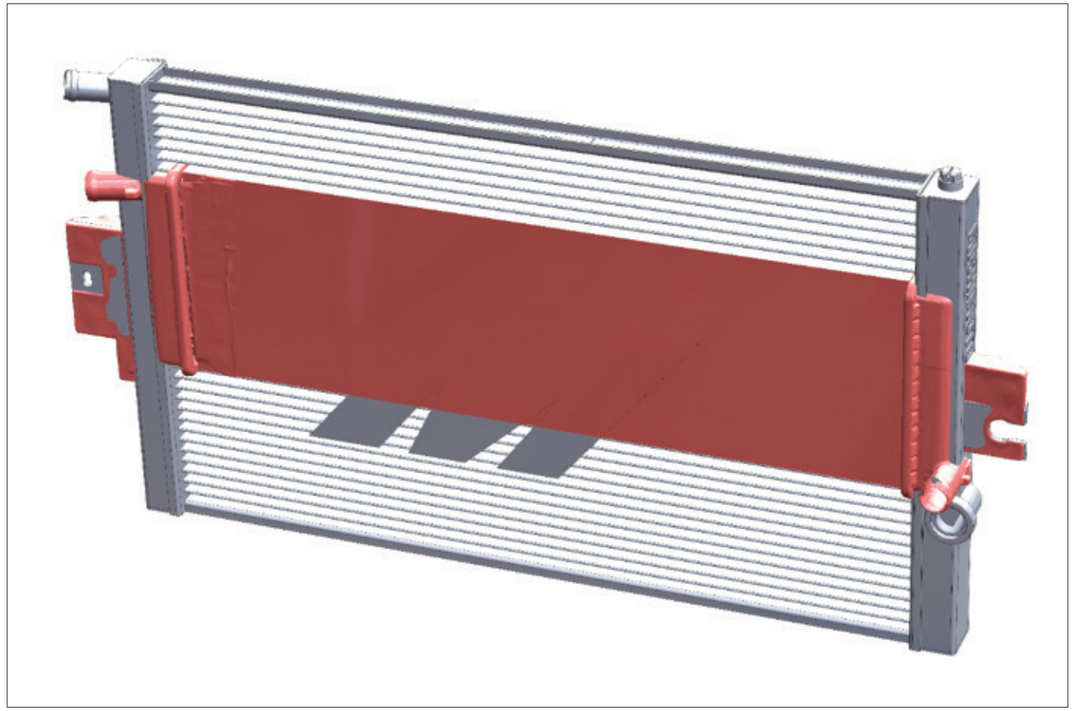

FIGURE 2: *Mishimoto heat exchanger overlaid by a 3D scan image of the stock heat exchanger (shaded red)*

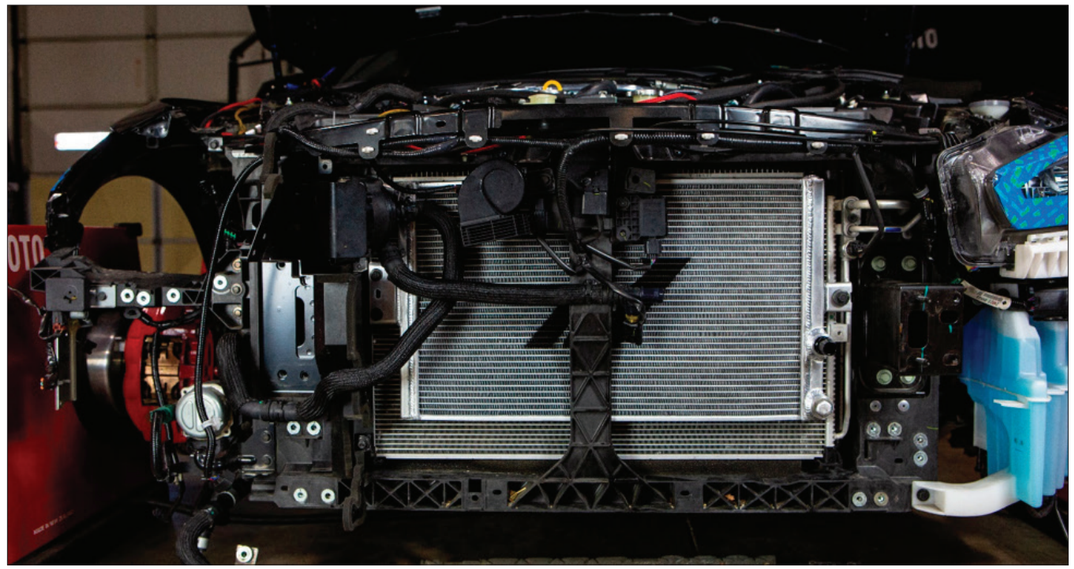

FIGURE 3: *Mishimoto heat exchanger (prototype) installed for dyno testing*

PERFORMANCE TESTING

Our testing vehicle was a 2016 Infiniti Q50 Red Sport AWD model with automatic transmission. All tests were performed on a stock tune, in 4th gear and sport mode.

All dyno tests were performed in-house on our AWD-capable DynaPack chassis dynamometer. The AEM AQ-1 data acquisition system is used to gather data from two temperature and pressure sensors installed near the inlet and outlet ports on both the stock and Mishimoto heat exchangers. Critical OBD-II channels, such as engine coolant temperature and ambient air temperature, were monitored for safety and to ensure realistic and consist results.

Heat soak performances of both heat exchangers were evaluated in a test where four dyno runs were conducted back-to-back with the intent to significantly raise charged air temps over a short amount of time and mimic real-world track racing situations. The starting inlet temperature was controlled at 82°F, close to ambient temperature for both coolers at the beginning of the heat soak test. Under these conditions, the stock heat exchanger outlet temperature rose to 139°F on the 4th run, whereas the Mishimoto heat exchanger saw a maximum outlet temperature of 118°F after the 4th run, 21°F lower than the stock setup due to the a much larger coolant capacity and external fin area increase.

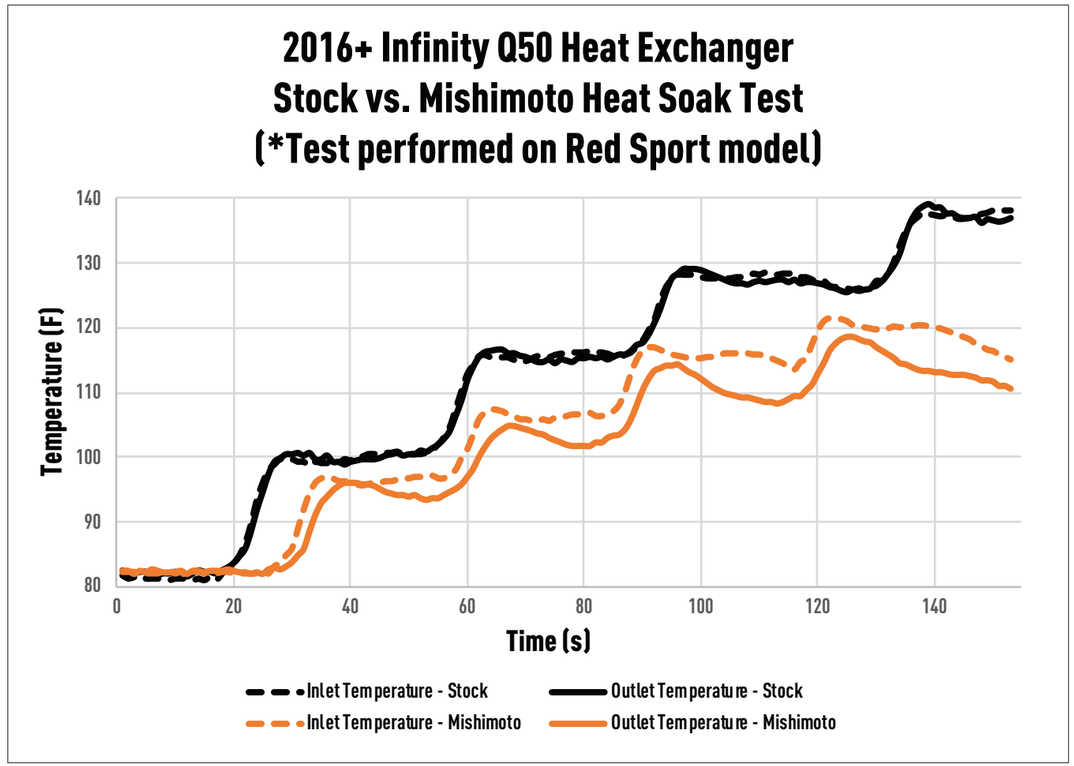

FIGURE 4: *Heat soak test results*

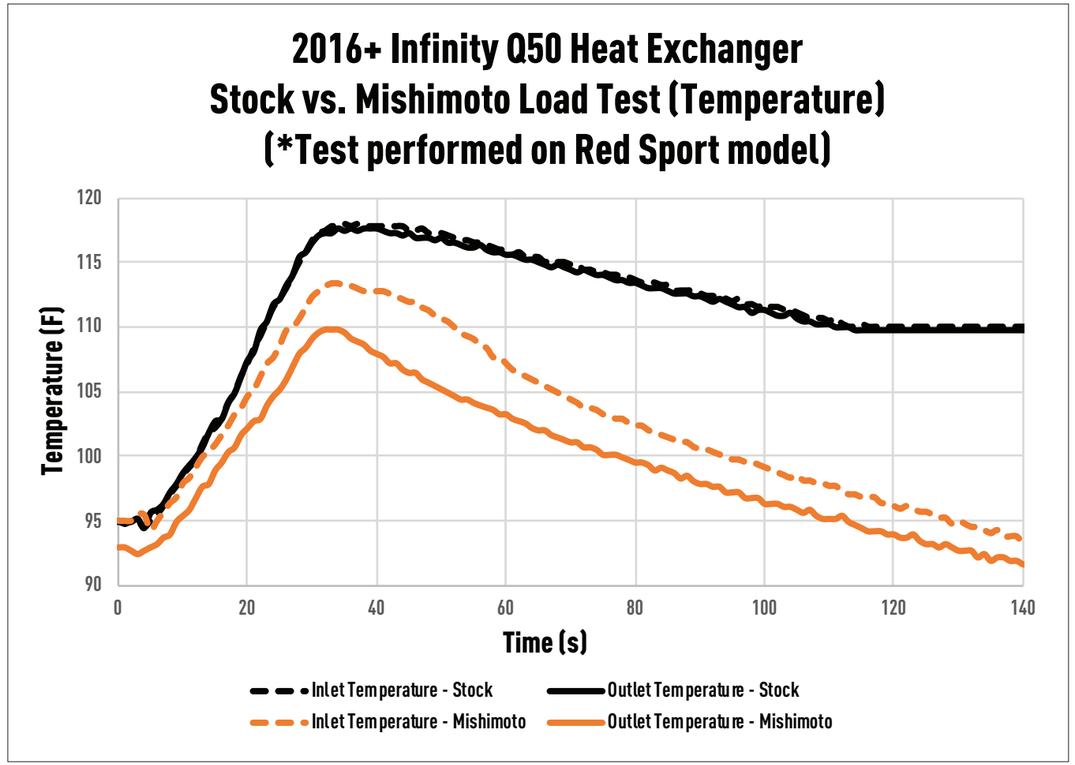

FIGURE 5: *Load test results (heat exchanger inlet and outlet temperatures)*

The dyno test that followed evaluates heat exchanger performance over an extended period (25 seconds) at 3000 RPM and under constant engine load. This load test also forces CAC electric pump to work constantly in high-flow mode during the 25 seconds, generating consistent flow rate for us to evaluate fluid pressure drop across the heat exchanger.

This test started with the inlet temperature at 95°F for both the stock and Mishimoto heat exchangers. The Dynapack is programmed to raise RPM from idle speed to 3000 RPM within 5 seconds, then hold at 3000 RPM for 20 secs. The stock heat exchanger outlet temp rose to 118°F around the 30 second mark and ended the test at the 140 second mark at 110°F. The Mishimoto heat exchanger outlet temp only came up to 110°F at the 30 second mark and dropped down to 92°F at the end of the test. With a Mishimoto heat exchanger, the CAC system can extract more heat from the charged air at a faster rate. At the same time, the Mishimoto heat exchanger recorded 5 psi of pressure drop, 3 psi less compared to the stock exchanger. This result is due to the significantly increased internal tube area of the Mishimoto heat exchanger. A more free-flowing cooler means that there is less mechanical stress on the CAC electric pumps.

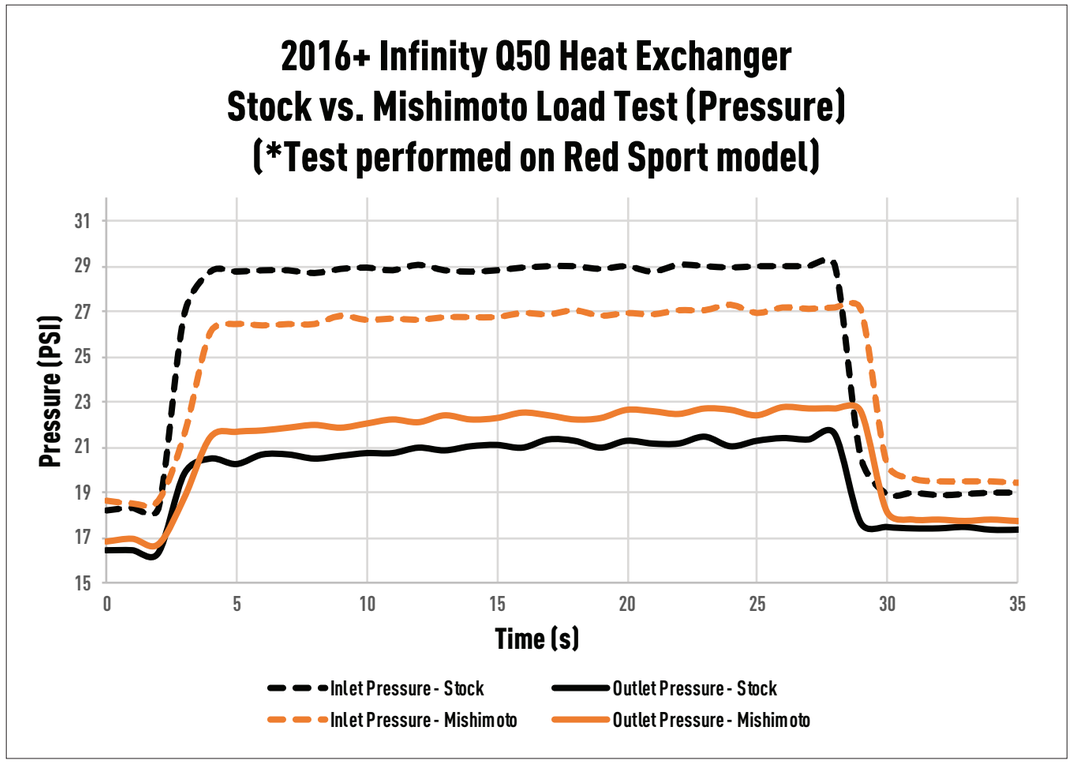

FIGURE 6: *Load test results (heat exchanger inlet and outlet pressures)*

INSTALLATION NOTES

The Mishimoto performance intercooler can be installed on the 2016+ Infiniti Q50 without any permanent modifications.

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