MISHIMOTO

# ENGINEERING REPORT

## 2011–2014 Ford F-150 Aluminum Radiator | SKU: MMRAD-F62-10

By Jason Wettig, *Mishimoto Product Engineer*

### REPORT AT A GLANCE

- **Goal:** Create a radiator that outperforms the stock unit. The Mishimoto cooler should fit directly into the F-150 without any cutting or modification required.
- **Results:** The Mishimoto radiator increased coolant capacity, fin surface area, and core volume when compared to the stock non-Super Cooling Radiator; 150%, 135%, and 60% respectively. When compared to the Super Cooling Radiator the numbers are as follows: 150%, 102%, and 60%. The Mishimoto radiator also kept overall engine temperatures 4°F lower during four back-to-back, 15-minute sweeps on the dyno. The increased core geometry promotes greater heat transfer.
- **Conclusion:** The Mishimoto radiator is a valuable upgrade for F-150 owners who drive their vehicles in hot climates or under extreme conditions. The upgraded heat exchanger helps to ensure coolant temperatures stay at optimal values during all driving conditions.

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## DESIGN OBJECTIVES

The design requirements assigned to this project are as follows:

- Create a radiator package that reduces fluid temperatures when compared with the stock configuration
- Must be a direct fit, with no cutting or permanent modification necessary

## DESIGN AND FITMENT

The R&D process began by evaluating the stock system and understanding how Ford chose to package their heat exchangers. Before the core could be increased in size, a general understanding of the allotted space was needed. A bigger size was picked out, seeing that there was a fair amount of room behind the stock fan shroud. Upon removing the upper radiator ducting, it became clear that the engineers at Ford wanted every bit of air to go through the heat exchangers on the front of the vehicle. Because the air ducting up front is very good, the fins and tubes can be spaced more densely than stock. New tube-and-fin spacing, along with the thicker core and more tubes, will allow for better heat transfer.

FIGURE 1: *The F-150 radiator mounted in the truck, showing room behind the radiator.*



The Mishimoto radiator increases fluid capacity by 150%. The radiator is much thicker and has more rows, therefore it can hold more fluid. Figure 2 shows the fluid capacity comparison between both stock radiators and the Mishimoto radiator.

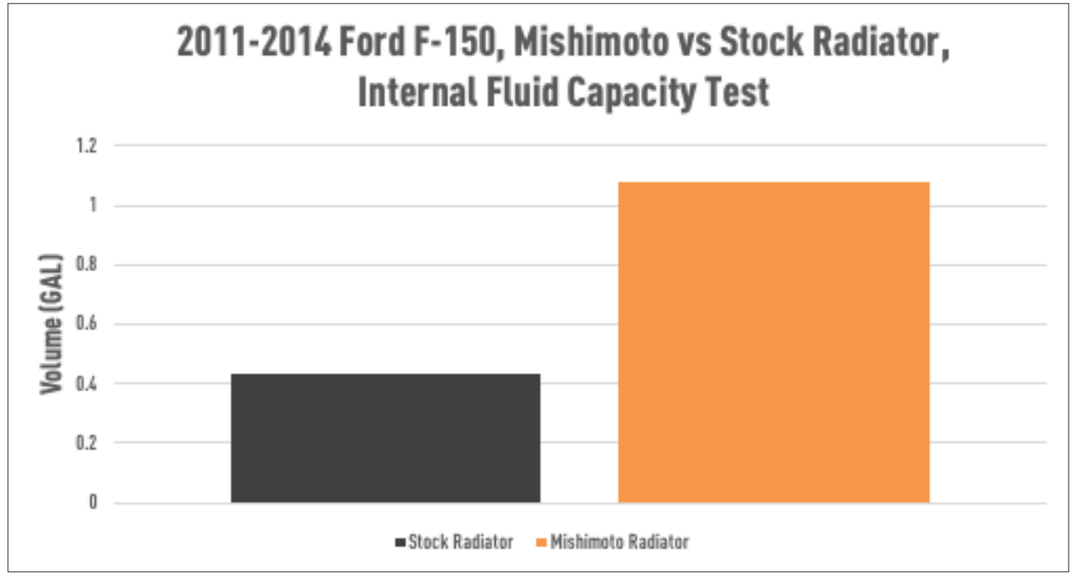


FIGURE 2: *The Mishimoto radiator features an increase in coolant capacity, which promotes greater heat transfer.*

The Mishimoto radiator also increases fin surface area by 135% when compared to the standard radiator and 102% when compared with Ford's Super Cooling Radiator. With the thicker core, more densely packed fins, and more rows, a larger amount of fin surface area can be created. Figure 3 displays this difference between the stock and Mishimoto radiators.

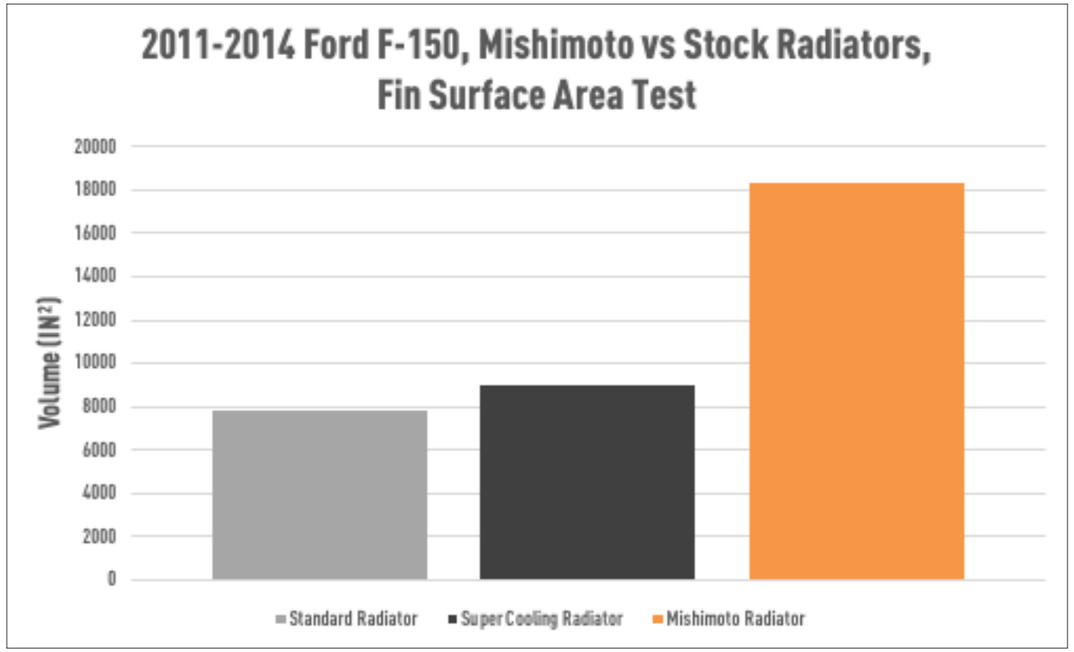


FIGURE 3: *The Mishimoto radiator features an increase in Fin Surface Area, which promotes greater heat transfer.*



An increase of 60% was seen in core volume when compared to the stock radiator. Figure 4 displays this difference between the stock and Mishimoto radiators. More information on the R&D process for the radiator can be found here on the Mishimoto Engineering Blog: **MISHIMOTO ENGINEERING BLOG**

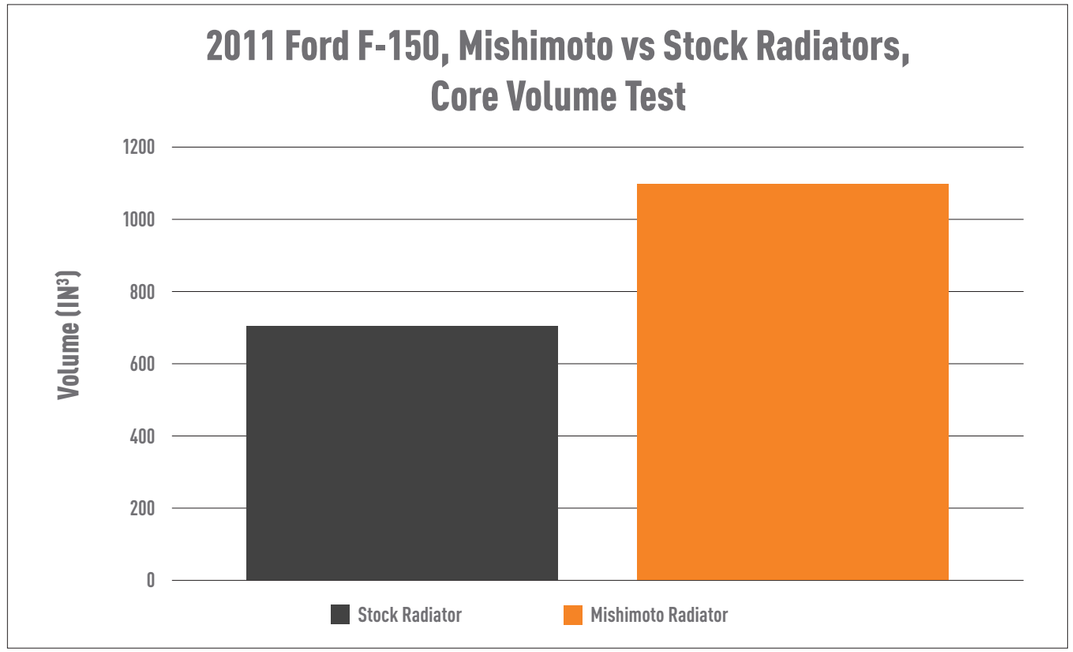


FIGURE 4: *The Mishimoto radiator features an increase in core volume.*

## PERFORMANCE TESTING

A Ford Raptor (with an exhaust, intercooler pipes, intercooler, and intake) was used for testing. The ambient temperature on the day of testing was approximately 72°F (22.2°C) with 50% humidity. To test the performance increases of the intercooler and heat-soak, a Dynapack™ dynamometer was used to apply a constant and repeatable load on the M2.

To test the performance gains as well as heat-soak of the Mishimoto intercooler, the F-150 Raptor was loaded onto the Dynapack™ and a 15-second sweep test under heavy load was devised. With the truck on the dyno, four consecutive dyno pulls were performed over the same 15-second interval.

From testing, it was clear that the Mishimoto radiator outperformed the stock radiator in terms of temperature drop and kept the trucks global coolant temperatures lower. The Mishimoto radiator was able to handle the heat much better than the stock radiator. The coolant system stayed cooler and cooled down faster than the stock setup. The results for temperature drop from testing on a stock tune can be seen in Figure 5.

FIGURE 5: *A Dynapack™ dynamometer was used for vehicle testing.*



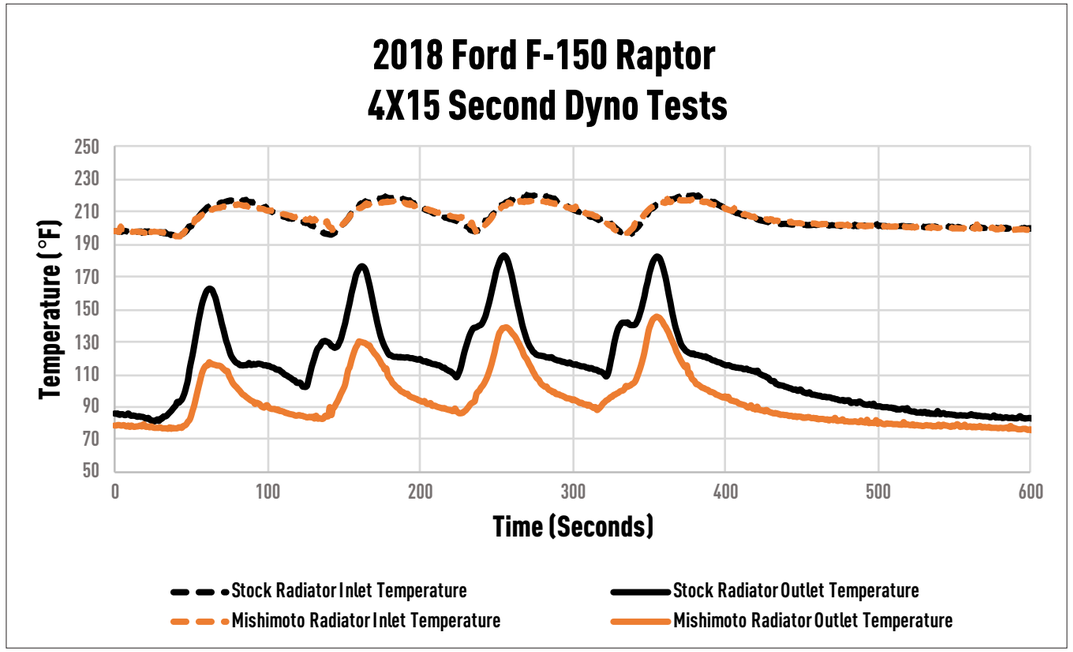


FIGURE 5: *This is the Mishimoto Radiator vs the Stock Radiator. Notice how the Stock outlet rises faster during the dyno pull while the Mishimoto outlet is slower.*

## CONCLUSION

The larger size and all-aluminum construction allow for lower coolant temperatures and increased strength when compared to the stock radiator. The Mishimoto unit has significant size improvements when compared to both stock radiators.

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