

Front Mount Intercooler Kit

This article describes the benefits of installing a front mounted intercooler over the stock location used by Mazda. This article also describes key features to look for in a well designed intercooler kit. The author has tried to keep the concepts simple and stick to what matters to most people: “What’s it going to do for me” and “Why do I care”. The equations that mathematically describe some topics discussed can be found in most basic physics and chemistry textbooks.

The Intercooler

The basic function of the intercooler is to cool air that is heated up when compressed by the turbocharger. If left hot, the air into the engine would be less dense thus results in loss of power and possible engine damage. Generally, you want the intake air temperature as cool as possible. This is one reason why your car feels more powerful in the morning or on cool days.

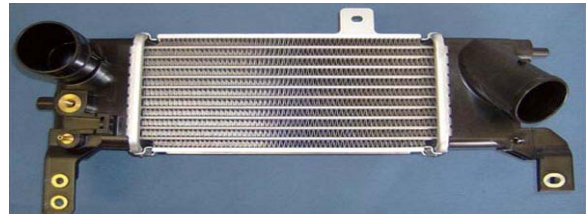
The intercooler operates much like the radiator in your car only cooling air instead of engine coolant. In a radiator, the coolant is cooled as it passes through the radiator by the airflow passing through the radiator from outside the car. A radiator is an air-to-liquid cooler. An intercooler is an air-to-air cooler. The compressed hot air enters the intercooler and loses heat to the internal fins of intercooler while passing through. Air passing through the intercooler from the outside cools the external fins on the intercooler.



The previous picture shows the cool air (blue arrow) from the outside going into the front of the intercooler and passing out the back as hot air (red arrow) after the heat transfer. The hot

compressed air from the turbo enters on the left and cool air exits on the right.

Our example vehicle will be the 2002-2003.5 Mazdaspeed Protégé (MSP). The stock intercooler used in the MSP is designed to meet the needs of the average driver while minimizing cost to Mazda. The MSP uses the same intercooler as the turbo diesel model 323/Protégé used in overseas markets.



The tube and fin style intercooler pictured above is typical for a Mazda turbo vehicle. This intercooler works fine in stock car with a “normal” driver. While the stock intercooler does the job without too much compromise between cost and performance for the average user, the enthusiast driver places higher demands on their cooling system. Enthusiast drivers should consider an alternative intercooler to the Mazda unit.

What’s the alternative?

Bar and plate intercoolers are a popular alternative for performance applications. The better flow characteristics (minimal pressure loss) of bar and plate style intercoolers make them an ideal choice over stock style tube and fin intercoolers.

Many cars see an increase of 1-2psi of boost (more power) when fitted properly with a bar and plate intercooler.

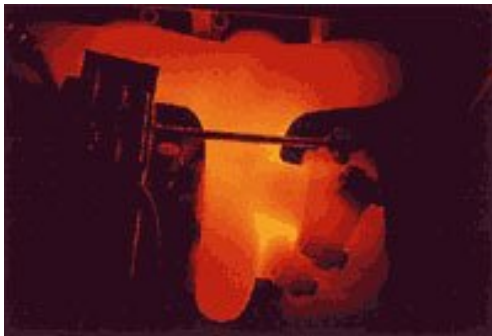
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The bar and plate intercooler shown below is same one used in the CorkSport Mazdaspeed Protégé front mount intercooler (FMIC) kit.



What are the benefits of FMIC?

The stock location of the intercooler in the MSP is marginal. It sits in the engine bay near the turbocharger and soaks up heat. This happens because the intercooler does not dissipate its heat into the hot engine bay very well.



The picture above shows a turbocharger and manifold under load glowing from the extreme temperature. The ambient temperature of the engine bay is one of the major causes of heat soak.

As mentioned earlier, this 'heat soak' results in a hotter air charge and thus less power. The increased temperature of the air charge can also lead to detonation which can damage the engine.

One primary benefit comes by moving the intercooler out of the hot engine bay and to the front of the car. The intercooler is then surrounded by cooler air in which to dissipate heat. The net benefit is less power lost to heat soak and decreased chance of engine damage.

Another benefit of most FMIC kits is the ability to cool a larger air charge. As exhaust, intake, turbo and engine are upgraded the demand on the intercooler increases. Even a simple increase in boost pressure on an otherwise stock car increases the demand on the intercooler. A larger intercooler gives increased margin for error against engine damage and less chance to lose power to heat soak.

Characteristics of a Quality FMIC Kit

Intercooler kits come in all shapes and sizes. This author believes there are key features that all quality front mount intercooler kits should have.

BEAD ROLLED PIPE ENDS: Ever wonder why there is a raised or beaded section on hard piping? The bead rolled end gives the pipe connectors a place to "grab" when clamped down. This keeps the connectors attached to the pipe under boost. You'll want to avoid the awkward circumstance of limping your car to the curb (or shop) for repair because your piping came apart under boost!



ALUMINUM PIPE: Aluminum piping offers weight savings and better heat dissipation compared to steel piping. Aluminum piping is more expensive but well worth the added cost.

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BRACKETS: It is important to have strong brackets to support the pipes and keep them in the intended places. By having TIG welded brackets, you are ensured a good looking and strong connection.



SILICONE COUPLERS: Quality pipe connectors are as important as the rest of the system. A durable and flexible junction is needed to absorb movement from the engine and chassis that could otherwise stress the hard piping and cause parts to break.



Silicone connectors offer superior strength and durability over the stock rubber and plastic connectors used by Mazda on its turbocharged vehicles.

HOSE CLAMPS: The little old hose clamp is a very important piece in the intercooler system. T-bolt clamps are an excellent choice over traditional worm-drive clamps while still offering great value. One advantage of t-bolt clamps is that they do not cut into the silicone couplers when tightened.

Another benefit is that they hold the silicone better than standard worm drive clamps by applying more equal force around the connection. The picture below shows t-bolt clamps. Notice the smooth clamping surface.



Also, t-bolt clamps use a nylon locking nut to keep the clamp secure once tightened.

Summary

For enthusiast drivers there are big advantages to upgrading to a quality front mount intercooler kit. The FMIC can give some extra power over stock from improved flow. Power loss to “heat soak” is minimized and engine damage is less likely. Don’t forget, front mount intercoolers look great!



Remember to look for bead rolled aluminum piping, quality silicone connectors, t-bolt clamps, and a bar and plate style intercooler core. The kit should come with all necessary additional hardware needed for installation.

FMIC kits can be tough to install, so insist that it comes with superior installation instructions and reliable technical assistance (should you need it).