

WRX Enhancement - Intercoolers

Part 3 of the most complete WRX parts buyers guide - EVER!

By Michael Knowling

The Standard Intercooler

All model WRXs have come factory-equipped with a top-mount air-to-air intercooler. Early models had air forced through their core by a smoothly contoured bonnet scoop - which also served to supply air to a cooling duct for the back of the turbo. Post MY97, however, a revised scoop went onto the bonnet and the whole of its capacity was focussed on a new (larger) intercooler with dual entries. No turbocharger cooling duct was required for these later models.

Without a doubt, the biggest problem associated with the WRX's standard top-mount intercooler is that there's not much charge air cooling when there is little airflow through the bonnet scoop (ie when the car isn't travelling fast enough). With fierce heat rising up off the engine, turbo and front section of exhaust, it's inevitable that the poor top-mounted core gets stinking hot. However, this situation is improved upon using any of the following off-the-shelf aftermarket intercoolers - either the (preferred) front-mount variety, or simply a more efficient version of the top-mount theme.

The Guide

All of the intercoolers listed below can be bought off-the-shelf.



Australian Subaru-tuning gurus - **BPM** - offer two upgrades over the standard WRX intercooler. This cheapest is this top-mount unit, which is said to give up to 40% better heatsink capability thanks to its highly efficient bar-and-plate internal design. But in addition to giving greatly enhanced charge-air cooling, it also gives less pressure drop at even modest boost levels. Certainly, a worthwhile quick bolt-on for a streetcar.



The more serious BPM front-mount air-to-air intercooler gives even further improved heat dissipation characteristics, as well as less pressure drop. Sold as a kit - complete with all necessary piping - this core uses all the space in front of the radiator while also freeing up space in the engine bay for a monster turbocharger... Both top and front-mounts are available to suit all models.

BPM is in Brisbane.



Tuning gurus - **ChipTorque** - sell both top and front mount intercoolers to suit MY94 - MY00s. Sourced from PWR, these cores feature bar and plate construction and offer maximum flow and heat dissipation. They are also impeccably built, with polished piping to take air from the turbo to the throttle body.

To go with these intercoolers (or the standard top-mount) are SAMCO silicone hoses, which keep intake temps lower and are much more suited to high boost applications.

ChipTorque is on the Gold Coast.



Trust/GReddy have their own front-mount intercooler to suit the post '97 WRX - measuring a sizeable 292 x 600 x 115mm. Readily matched to a standard or VF series turbocharger, these intercoolers feature GReddy's own high-density inner-fin design to deliver apparently supreme performance. It is also designed to fit into tight spaces and make the most all of the available space.

GReddy intercoolers can be purchased through Evolution R in Melbourne.

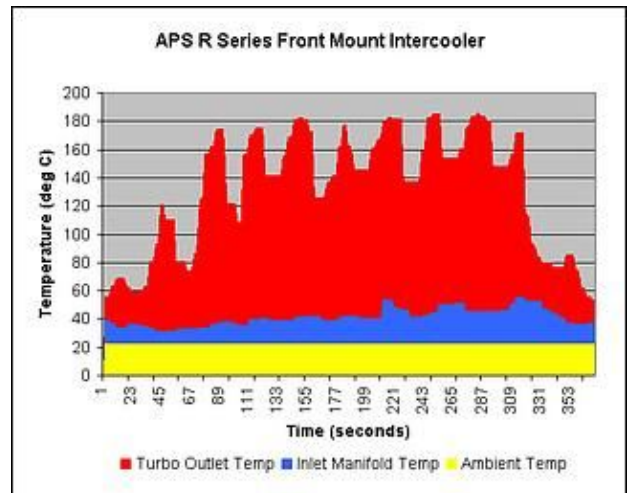


An improvement over the standard WRX's intercooler is **APS's** Dual Entry top-mount unit. The twin entry pipes reputedly serve to better spread the cooling effect on the intake charge and the design is also said to have superior flow capabilities over the standard core. Note that the APS dual entry intercooler can be bought with APS high temperature silicone 3-ply connection hose. The biggest benefit of this is improved tolerance of extreme boost pressure and temperature. APS's Dual Entry top-mount intercooler is available in two models - one to suit the MY97 - 98 and another for the MY99 - 00, plus STi Version 5 2-door and Version 6 4-door.



The ultimate hi-po offering from APS is their R-Series front-mount intercooler, which utilises every last bit of space at the front of the car (while still retaining the factory driving lights).

The APS website states that it is "more efficient than any top mount intercooler" with a massive cooling surface area of 1440 square centimetres (compared to the standard 536). It incorporates cast aluminium trapezoidal end-tanks to give improved charge air distribution as well as minimal flow restriction. APS give the example of one heavily modified WRX running 25 psi from a big turbo. At 7000 rpm, its total induction system pressure drop was only 1 psi - and that was including the throttle-body!



To cope with high boost (which is likely when you're using this sucker!), APS utilizes Nomex-reinforced silicon intercooler hoses. These APS silicon hoses offer more protection against under bonnet heat soak than either steel or stainless steel tubing. The R-Series intercooler is available to suit MY97 - 00 Rexs and both Version 5 and 6 STis. Customers have the choice of surface finish too - stealth black, raw or polished aluminium.

APS are Melbourne based with dealers Australia-wide.



Power Engineering offers a unique shield for the standard WRX top-mount intercooler - the aim of this device is to protect the core fins from the onslaught of on-coming debris. Once a few big bugs (or whatever) have hit those cooling fins, it is quite likely they'll be bent - causing an inherent reduction in cooling efficiency. The shield comes complete with mounting screws and is available to fit MY97-on models.

Power Engineering is in the UK.



Designed as a bolt-on replacement of the standard top-mount intercooler, the bar-and-plate **AVO** unit improves reliability at high boost levels and increases horsepower. In fact, it has proven to reduce an otherwise standard Subaru WRX's quarter mile time by 0.3 seconds (with an extra 4 mph carried over the line). On an MY94 running 12 psi boost, the standard intercooler is measured to give post-intercooler air temps of 58 degrees C with a pressure drop of 1.5 psi. With the AVO intercooler in place and the turbo set to a higher 18 psi, the intake temps fall to 52 degrees and the pressure drop is **1/3** less.

This core is available to suit MY94 - 99 models.



The AVO Water Spray Kit is the perfect addition to the above top-mount intercooler enhancement. Sensing throttle position, inlet air temperature, MAP and airflow meter voltage, you can adjust trigger values and switch a water spray pump rated to 12 amps. Two LEDs also illuminate to show the activity of the system. Note that the final addition to a complete AVO top-mount intercooler package should be their red and blue silicone intercooler hoses, which are more durable than the standard items.



For those chasing absolute minimal intercooler pressure drops and maximum charge-air cooling, the AVO front-mount 'cooler is right up your alley. Again, featuring bar-and-plate core design, the front-mount performs well up to expectations and comes together with HPC'd steel intercooler piping and high pressure/high temperature hoses. This front-mount core is available to suit MY97 - 99 WRXs.

AVO is located in Melbourne.



A'PEXi front-mount intercoolers are at the nose of many-a sub 13-second WRX. And with good reason... The A'PEXi GT-spec intercooler features a highly sophisticated cross-flow fin design. A'PEXi engineers have also created this built-for-front-mount intercooler so that it doesn't overly impede flow through to the engine radiator.

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Purchasing a complete kit sees you equipped with stainless steel intercooler piping and all hardware. A nice kit that's a sure high-performance bet.

A'PEXi gear is available at BEL, BGT, Jap Trading, G-Tech and the AutoSpeed shop.



MRT (Middleton Rally Team) retail this WRX replacement top-mount intercooler, which bolts straight onto the factory mounts. With a bar-and-plate core measuring 460mm x 280mm x 90mm, the product also features fabricated alloy end tanks with a dual entry pipes. The engine side end-tank even has an integrated facility to fit a blow-off valve. The MRT top-mount intercooler suits Version 4 STis and MY97 - 98 WRXs. Another version (with simply a flange fitting for a blow-off valve) is available for Version 5 and 6 STis, plus MY99 - 00 WRXs.



A front-mount intercooler kit is also sold alongside the top-mount. Using a 450mm x 250 x 90mm bar-and-plate core with alloy plate end-tanks, it comes beautifully assembled with stainless TIG welding and silicone high pressure joints.

Once installed, the kit does not sacrifice ground clearance, as the factory front tow hooks still reach down lower than the stainless steel pipes. Small modifications are needed on the original front bar, however the driving lights can (just) be kept. Note that the standard airbox cannot be retained with this type of front-mount intercooler - a Rampod or equivalent is necessary. MRT state that this is "simply the best hand made intercooler on the market" offering "a dramatic performance improvement". It can be bought to suit all models - and an optional remote blow-off valve pipe can also be supplied.



MRT also sells a large assortment of intercooler related hardware.

Their silicone pressure hose kits replace the Australian delivered WRX's thin, plasticity turbo hoses - which are prone to melt and split under duress. In addition to these lengths of silicone hose, you also get the necessary alloy intercooler supply pipes. An intercooler-to-blow-off hose is available as well (top-mount intercoolers only).



MRT is also the place for intercooler water sprays.

Starting with the most basic full-manual set-up, you can simply wire this genuine STi manual intercooler spray switch directly to activate your nozzles. This gives you complete manual control of the nozzles via a perfectly integrated push-switch. A better option, however, is to use the MRT Standard Water Spray Kit - which uses the standard MAP sensor signal to give adjustable boost pressure trigger values. This can be wired to the above STi manual and/or auto switch for elegant installation. The most sophisticated water spray controller from MRT is the Smart Switch Water Spray Kit. This is similar to the Standard Water Spray Kit, except it also uses a water temperature input (again, from the standard WRX sensor). Both boost pressure and water temperature trigger values can be adjusted to ensure the spray is operating only when it needs to be - thus minimising wasted water. This kit, too, can be rounded out with genuine STi switch gear.



To go with the above control systems, MRT most recommend the use of genuine STi water spray nozzles. These deliver a finer mist compared to some other alternatives (for potentially better heat absorption) and are easily mounted above any top-mount or front mount intercooler. Note - two nozzles are required on a standard top-mount intercooler.



The tank and pressure components of the water spray system can be configured in various ways. MRT have this elegant twin pump replacement washer bottle (one pump is dedicated to the intercooler spray), which screws straight in for a totally stealth installation. Alternatively, separate windscreen washer-type pumps are also available for a DIY set-up.

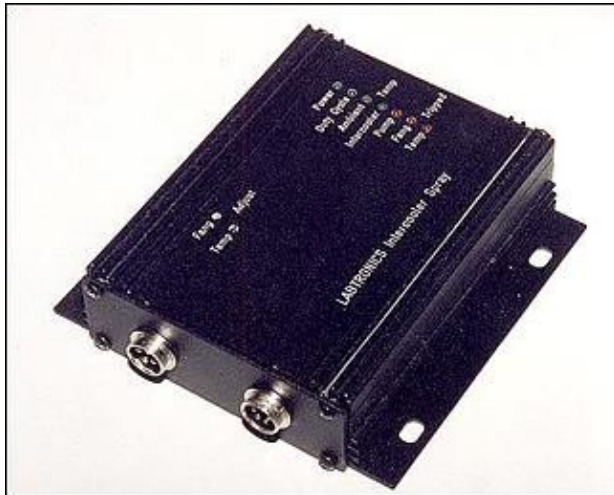


A big step up over the washer-type pumps is this Super Hi-flow water spray pump. With similar flow and pressure to the genuine STi spray pump, this agriculture-designed unit is ideal for long, hard use. Essential for extended use (ie track days etc). When you fit one of these big-sucker pumps, the MRT alloy boot tank is then the perfect place to store those many necessary litres of water. Custom fabricated (modified further to suit 5-door WRX hatches), these come complete with an alloy cap, screw filler and clear sight gauge.

MRT - Middleton Rally Team - lives in Sydney.



One of the top Japanese parts producers - **HKS** - offers a typically high quality front-mount intercooler assembly to suit post-MY97 WRXs. These tube-and-fin designed cores are said to offer maximum heat dissipation with minimum pressure loss. The HKS kit comes complete with all necessary plumbing, hoses and clamps. It's beautiful stuff - but it's not cheap though... HKS intercoolers can be sourced through Evolution R, BD4s and WAR Motorsport.



Developed by **AutoSpeed/Labtronics**, the Intelligent Intercooler Water Spray has proven extremely popular - and would make an ideal fitment to the WRX's top-mount core. The IIWS has a control system that actively monitors how the car is being driven, senses ambient air temps, intercooler temperature and injector duty cycle. The result is a system that only sprays water when it's genuinely needed - so you don't need to carry a huge water tank for that run-wild spray nozzle. It's undoubtedly the most sophisticated water spray controller in the world!

The Intelligent Intercooler Water Spray can be purchased through the AutoSpeed shop in two versions. Note that the required pump and spray nozzle are not included.

Note: If you are a manufacturer of high performance intercoolers for the WRX - and you're not listed here - we'd be delighted to add your products to the guide, free of charge. Contact Michael at michael@autospeed.com

Contacts:

ChipTorque (Qld)
+61 7 5596 4204

www.chiptorque.com.au

TurboSmart (NSW)
+61 2 9798 2866

www.turbosmart.com.au/

Go-Fast Bits (NSW)
+61 2 9569 7648

www.gofastbits.com.au

Evolution R (Vic)
+61 3 9543 6255

www.evo-r.com

APS (Vic)
+61 3 9720 9170

www.airpowersystems.com.au

MRT (NSW)
+61 2 9809 2110

www.mrtrally.com.au/

BGT (Vic)
+61 3 9874 8866

www.bgtperformance.com.au

G-Tech (Vic)
+61 3 9813 0722

www.gtech.com.au

AVO (Vic)
+61 3 9584 4499

<http://www.avoturbo.com/>

BPM (Qld)
+61 7 3272 8885

www.bpmssports.com/wrx.htm

WAR Motorsport (NZ)

www.warmotorsport.com

Jap Trading (Vic)

+61 3 9879 7799

www.jap-trading.com.au

Race Logic (UK)

www.racelogic.co.uk

BEL Performance (NSW)

0412 262888

www.belperformance.com.au

BD4s (NSW)

+61 2 9879 3322

www.bd4s.com.au

Power Engineering (UK)

www.powerengineering.com.uk

Cool Stuff...

A turbo force-feeds air into the engine, making it breathe more than it otherwise would. When the right amounts of extra fuel are also added, this lets the engine develop a lot of grunt. However, there's a downside to pushing in air under boost - it gets hot. Hot air gives you less of a power gain than you'd otherwise be getting (because it's less dense), and the hot air is also more likely to cause detonation. To try to bring the temp of the intake air back down again, an air/air radiator called an intercooler is used in between the turbo compressor and the intake manifold.

Intercoolers do two things - they absorb heat from the on-boost air, and they also dissipate it to the outside air. If you've been off boost for a while and then floor the throttle, the temp of the air coming out of the intercooler will be pretty much the same as it was before you planted your foot. But keep your foot down hard and, after a few seconds, the intercooler will start getting hot - and then so will the intake air. If the intercooler is under the bonnet - like in a standard Rex - and you've been idling along in city traffic, the intercooler core will **already** be hot - bloody hot. Go for a big clutch dump off the line in those conditions and the intake air temp will just rocket. So you need to aim for two biggies - an intercooler core that is fairly cool to start with (and in lots of driving conditions that means that it shouldn't be mounted under the bonnet!), and one that can get rid of heat as fast as possible.

The other aspect to look for is minimal airflow restriction. If there's a 2-psi pressure drop across the core, it means that the turbo needs to push 17 psi for a 15 psi dashboard measurement. Extra turbo boost equals extra heat, so you can see that a restrictive intercooler is sending you around in a circle.

Intercooler water sprays can be either very effective - or hopeless. To be good, you need high quality

spray nozzles that deliver a very fine (small droplet) spray, and you need good logic in the control system. A boost pressure switch or manual switch will waste a heap of water, while sprays triggered by load or intake air temp are better. Best of all (if you'll forgive our bias) is a spray controller that takes into account the difference between the temp of the day and the temp of the intercooler (or intake air), and also monitors engine load. AutoSpeed has covered the development of our own intercooler water spray controller that takes this approach, starting at ["Intelligent Intercooler Water Spray, Part 1"](#).

Finding out the effectiveness of an intercooler - whether it's a standard or aftermarket fitment - is very easy and cheap to do. First up, measure the intake air temp in the plenum using a digital fast-response LCD thermometer. AutoSpeed has covered the installation of this type of instrument (["LCD Temp Display!"](#)) and we've also done stories on a more sophisticated design that will also measure exhaust gas temp (["TempScreen: Part 1 - Installing the Intake Air Temp Probe"](#)). When you put in an intake air temp gauge, make sure that you watch it in your normal driving for a few weeks - you'll be surprised in what conditions max intake temps actually occur. To check on the pressure drop that is occurring, measure max boost before, and then after, the intercooler. The difference between the figures shows the intercooler restriction.

So what do you want? Easy - the lowest intake air temps and the smallest pressure drops!

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