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Subaru BRZ MY12-On Toyota 86 MY12-On



Introduction - The Standard Car

If you cast your mind back a little over a decade ago, Subaru made the bold announcement that they would no longer build 2WD cars and their lineup would consist solely of AWD models. Back then, who would have thought that around now they would be collaborating with Toyota and building a RWD sports coupe..!?

There was a lot of hype leading up to the release of the BRZ/86 both here in Australia and internationally, and much of it has continued post release with long delays on delivery of new cars from Dealers. Some of the hype is well deserved – the cars punch well above their weight in the looks department, turning heads at 500m like cars 10x the cost. They are also reasonably well equipped, possess awesome handling and vehicle dynamics and are very keenly priced. On the downside the brakes could use a touch up and the power output from the peaky naturally aspirated 2.0L doesn't really match the feel and appearance of the rest of the car. Aside from meeting ever more stringent emissions targets, why Subaru decided to shelve 20+ years of turbo boxer engine knowledge and fit this newly developed engine is anybody's guess.

The BRZ and Toyota 86 are fundamentally the same car, albeit for some minor changes to differentiate the models (and price tags at Dealerships). Engine and drive train are all identical as are the transmission choices (6 sp manual or 6 sp automatic), although there are some small differences in brakes between some Toyota 86 variants and the BRZ runs slightly firmer spring rates than the Toyota.

The 147kw / 205Nm naturally aspirated 2.0L engine achieves its peak power and torque quite high in the rev range and needs to be revved to get the most from it. It also features a new combined direct and port fuel injection system (one set of high pressure injectors injects fuel into the combustion chambers



directly, while another lower pressure set of injectors mounted in the inlet manifold inject fuel prior to entry of air into the cylinders) which the engine management system selectively switches between to best meet emissions requirements.

As a base package, the BRZ/86 offers an excellent starting point for some additional “finishing touches”. Anything from some basic suspension and brake upgrades (more information on which is available on our website), right through to turbo or supercharger conversions for dramatic increases in performance!

Performance Improvement – Our Goal

In looking to achieve increases in performance, there are several areas that need attention – our key aim is always to improve efficiency of the package as a whole in order to achieve well balanced results. Most of our clients buy their cars for enjoyment in a variety of environments (day to day commuting, spirited highway use, occasional track days, etc), but by far the most common is as a daily driver. On that basis, modifications which make a car too loud, consume fuel like someone else is paying for it, drive poorly with no torque at lower rpm, ride harshly, etc aren't our focus.

Gone are the days when you simply bolted on an exhaust and hoped for the best. We aim to take what the factory supplied you and improve on it after thorough testing and development – this is also why we guarantee and provide a warranty for all of the work completed by us or our resellers.

Factory Warranty Guarantee

When sold new, the manufacturer of your car provides a fairly specific warranty that covers a variety of things for a predetermined amount of time or distance travelled. Problems caused by poorly thought out or performed modifications however are generally not one of them! Where a problem with your car is completely unrelated to any modifications made (for example, your air conditioning fails 12 months after you have a power kit fitted) this is generally STILL covered by your factory warranty. However if you increase the performance output of your engine and your transmission fails, it is unlikely they will be too interested in repairing it under warranty.



Fortunately, where a full MRT Power Kit is fitted (by either us or one of our resellers) we will generally take up where your factory warranty ends to the extent that the vehicle is affected by our modifications. Of course there are some exceptions (such as outright race or track use – more information on our website at <http://www.mrtperformance.com.au/about-us/the-best-warranty>), but put simply, if we fit something to your car which impacts on its reliability, we will rectify the problem under the terms of our warranty.

Fuel Economy

In these times of ever increasing fuel costs, one of the main queries we get is how your car will be impacted by any modifications. Truth be known, in order to get better performance from your car two things happen:



- We need to make the engine more efficient throughout the rev range. Whether this comes through fitment of additional parts or changes to engine operating parameters, the aim is the same.
- ECU mapping is optimized to ensure the engine is operating with the most suitable settings for the combination of parts fitted.

As a result, during normal day to day driving your engine is actually working more efficiently and burning less fuel as a result. Of course when you are working the engine harder to extract higher levels of performance, you will burn more fuel (no way around the basic fundamentals of a combustion engine there sorry!) however remember that this is less than 10% of the time you are driving.

On balance, most of our customers who have had an MRT power kit fitted over previous years have provided feedback which confirms this. Depending on driving style, many notice no increase in overall fuel consumption and many have come back with gains of 0.5-1.5L/100km.

MRT Power Kits – What Options Do I Have?

We have many customers who come to us with a predetermined figure in mind - how much faster they want to go, a certain amount of power, or a preset budget are all common. We have many years behind us of preparing custom combinations to suit specific requirements for customers, be it road, race or rally.

However through our years of experience on Subaru, Mazda and Mitsubishi performance models, we know that certain combinations of parts produce certain results. Of course different engine configurations respond differently to various combinations, however we are able to break it down into various stages to suit each model. This allows you the peace of mind of knowing how much you are going to spend and the performance gains you will receive well in advance of any work starting.

Typically most of our supported vehicles come with 2 – 3 performance upgrade kit options:

- **XA Kit**

Entry level kit with a mild power increase but primary focus on improvements to mid range torque and day to day drivability. The XA Kit typically has no or minimal noise increase over a standard vehicle.

- **XB Kit**

Mid range kit designed more for the owner who wants that little bit more from their vehicle, both in terms of performance and sound. Significant improvements in torque and power, with a much broader torque curve compared to the standard vehicle, are the main targets and the kit usually includes an exhaust system upgrade (which provides an added audible improvement at the same time!).

- **XC Kit**

Upper level kit for the more performance orientated owner. Typically kits include a turbo upgrade along with supporting modifications in the quest for much larger outright power gains over a standard vehicle.

Upgrading between kits is feasible (check FAQ section at end of this document for further information).



All of our kits are designed for engines that will be run on 98 Octane fuel (eg Shell V-Power, Caltex Vortex 98, BP Ultimate 98, etc). However if you are in a remote part of Australia and can't get 98 RON fuel on a regular basis, then we can still help.

Please contact your nearest MRT reseller for further details on any potential impacts on performance (engines generally need to be detuned slightly to retain reliability to suit lower octane fuel).

All initial testing, development and verification of results has been (and continues to be) completed on

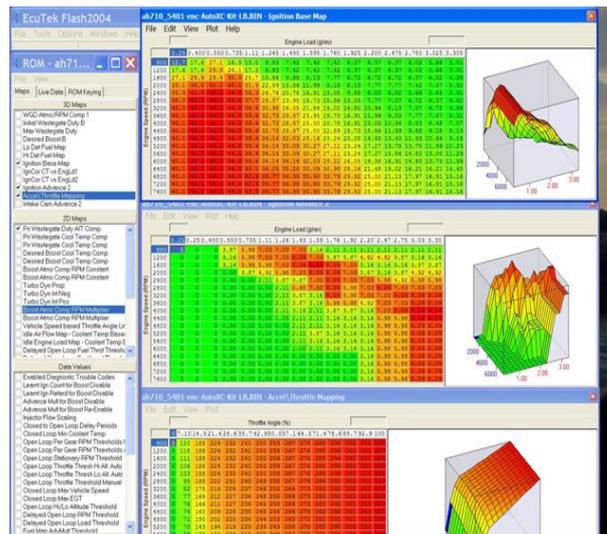
our in house 4WD Dynapack Chassis Dyno. Dyno time is not normally included as part of our kits due to the level of testing and development already completed on associated mapping work, however if you wish for any specific kit to be custom tuned to your requirements it can be easily done at a slight extra cost.

Why EcuTek?

All MRT power kits retain the use of the factory engine management system hardware, recalibrated for optimum engine control through the use of EcuTek software.

Some people prefer to remove the factory management system and fit a complete replacement ECU (or interceptor style unit which overrides some aspects of the factory management systems control), however this is not our preferred method for several reasons.

When tuned correctly the factory engine management system allows you the best of both worlds – factory or better than factory drivability, with the best possible performance from your chosen combination of modifications.



Certificate Of Authenticity

Be sure you get what you pay for! With the success of the MRT Power kits over the years, some companies try to pass off inferior parts and options that replicate what we do. However we guarantee our results because we only use proven parts and the best engine management system technology in EcuTek software.

With each tune or upgrade completed, you will be provided with an individually numbered Certificate Of Authenticity to show what has been completed on your vehicle. To register it, simply complete the detachable feedback details and drop it in the (reply paid) post.



This isn't something just anyone can do however, we (and our resellers) use proven EcuTek engine management software to upgrade your existing OEM engine management system with the required settings. In doing this, you'll get:

- Good fuel economy via accurate closed loop fuel control.
- No wiring or hardware modifications to the electronics of your car (100% reliability).
- The same or better emissions output from your engine (many OEM setups run quite rich air/fuel ratios at higher rpm levels).
- All of the OEM safety parameters such as active knock control and boost limiting adjusted to suit. This means if something isn't going according to plan (eg detection of detonation due to the use of poor quality fuel for example), your ECU can respond accordingly to prevent engine damage in most cases.
- Optimum setup and control of the latest engine management system features such as variable valve control, electronic throttle control (including access to all 3x SI Drive modes on Subaru models where fitted) and more.

We have used EcuTek software to reprogram the Subaru and Mitsubishi factory engine management systems on everything from standard cars right through to heavily modified cars with enlarged engine capacity, massive turbo and intercooler combinations and nitrous of all things!

Road or race, the results are on the board – why use anything else?

EcuTek RaceROM – Race Car Features For Your Road Car

Using newly developed EcuTek software trickery, we can now setup and configure (small additional cost may apply depending on configuration request) additional features previously only found on high end aftermarket engine management systems (those typically found in race vehicles).



These new features can be enabled permanently, or switched on/off in various combinations on the fly. In models with SI Drive functionality (typically MY07-on Liberty GT or MY08-on STi), we can make the most of the inbuilt functionality this system provides, or in the BRZ/86's case modes can be switched using either the cruise control switch or a combination of full throttle and rear demister switch with mode selection indicated on dash via CEL flash sequences.

- **Map Switching (Up to 4x Maps – Road, Road+, Race and Race+ Modes)**

Map switching gives the ability to swap between multiple calibrations that can be tailored to your requirements. Road modes and Race modes (ie one lower performance map for road use and a higher performance map for spirited driving or race use) are common choices, but setups for low octane and high octane fuel could also be specified, or variations thereof as an example.

Additionally, each of the maps can also include their own combination of RaceROM features as per below. Switching calibrations can be done on initial startup or even whilst driving.

- **Flat Foot Shifting (also known as Gear Change Ignition Cut – Manual Models Only)**

Flat foot shifting allows the driver to shift up into the next gear without lifting their foot off the throttle. The ECU automatically detects the clutch being depressed and instantly retards timing to prevent engine RPM rising higher. Whether you change gears quickly (normally the aim under such conditions) or slightly slower than usual, the ECU won't reinstate full throttle and ignition timing levels until the clutch pedal is released. This stops any drop off in power and completely reduces delay on gear change for that perfect quarter mile time or flawless traffic light grand prix performance.



- **Automatic Throttle Blip On Downshift (Manual Only)**

The automatic throttle blip feature applies a short burst of throttle when the driver is down shifting under brakes. This raises the RPM to provide a smoother entry into the lower gear by reducing engine braking and better matching the RPM of the next gear to road speed. Can be configured to suit your preferences, but typically only activated above ~40 kph to prevent unnecessary activation when driving around car parks etc.

- **Launch Control (Manual Models Only)**

Limits RPM whilst the vehicle is stationary and clutch is depressed, allowing the perfect launch. Additionally, whilst Launch Control is activated, small adjustments up or down in the RPM level that is being held can be made via the Cruise Control stalk. Check out Brett's ~1min 30sec video on YouTube to see it in action – just search for "Subaru BRZ Launch Control". Very cool feature!

- **Speed Density Mapping**

The Speed Density feature changes the way the engine management system calculates engine load. Rather than using the MAF sensor reading, it instead calculates mass airflow based on engine speed, manifold pressure and air temperature. In English, that basically means the MAF sensor can be removed or largely ignored in ECU calculations and a larger intake of any design to be fitted if wished. In conjunction with a replacement 3 bar MAP sensor (OEM sensor is only 1 bar), this allows for all manner of turbo or supercharger configurations to be fitted. Perfect for that big horsepower setup you are chasing..!



- **Per Gear RPM Limiting**

This feature allows per gear rev limits to be configured. For example this could be used to improve 0-100kph times by allowing a higher 2nd gear limit (thus preventing an additional gear change) yet allowing regular limits in other gears. The same setup could be configured for quarter mile racing as well.

Of course some of the above features are more beneficial to certain types of vehicles (or certain combinations of modifications on a vehicle) than others. Some are simply just heaps of fun too (launch control, flat foot shifting and auto blip on downshift would be our favorites, and the most requested by clients). In conjunction with the Map Switching functionality, you can have some, all or none of the options enabled to suit your mood...it is completely up to you.

Please note however, that software trickery is one thing, an engine built to handle higher sustained rpm limits or a transmission built to handle constant hard launches from standstill another. The additional features are normally found on race cars for a reason – they have engines and transmissions built to suit. Our Factory Warranty Guarantee doesn't extend to covering engine, transmission or clutch failure on vehicles equipped with launch control or flat foot shifting functionality for example.



Subaru BRZ/Toyota 86 – XA Kit

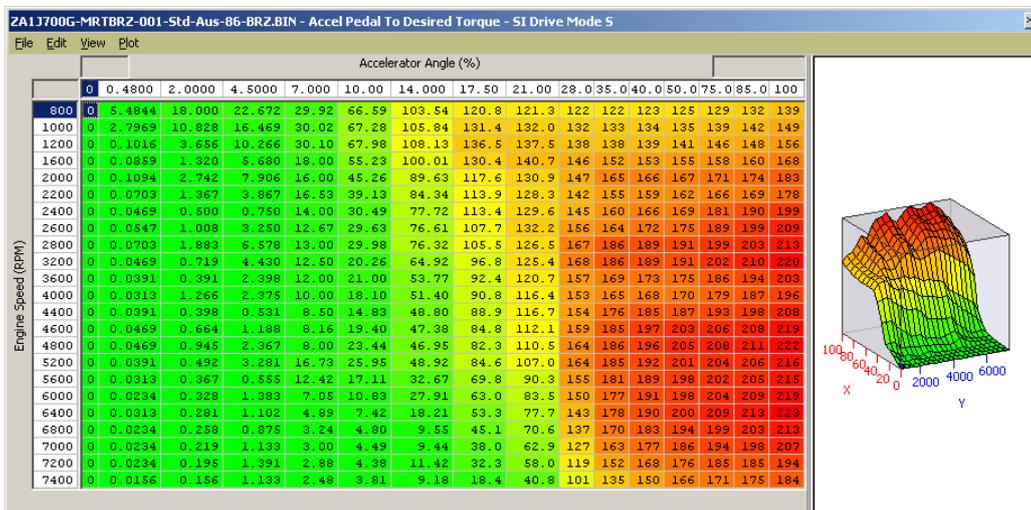
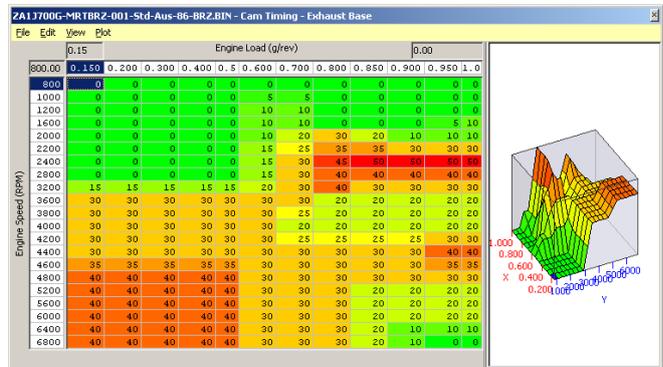
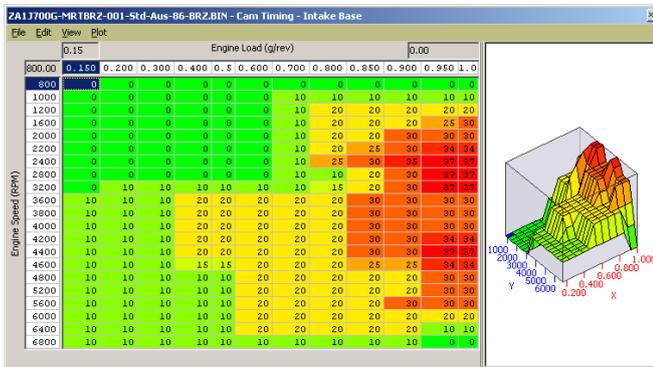
With the grand total of 12km on the odometer, our development car was delivered by tow truck from the Dealer and reversed directly into the dyno room so work on the engine management side of things could start.



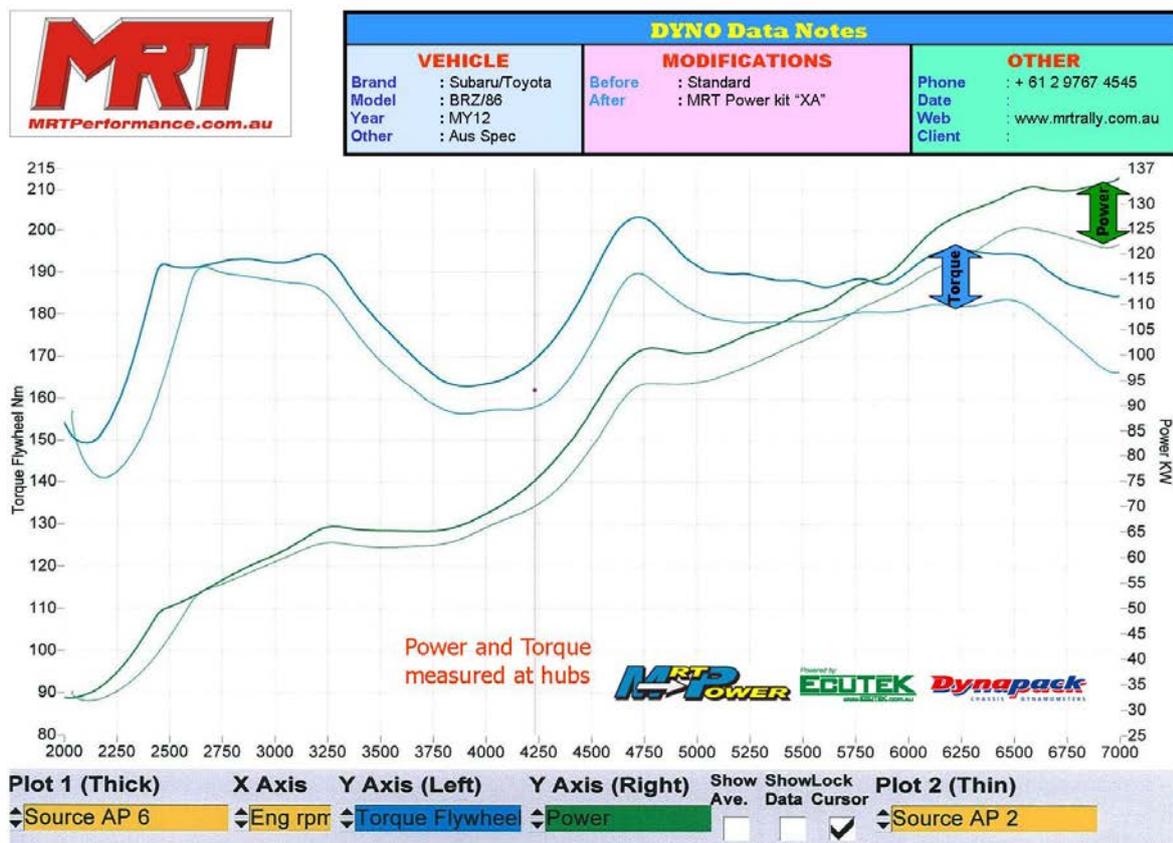
Before we get into the results, as an interesting side note the first 20km or so travelled in the car were on our dyno being run in and tested. The car then had a further 650km or so of road use stacked on with suspension and brake development being undertaken, before making its way back to the dyno for final testing and engine management system calibration development.

With the additional km on board there were notable improvements in torque output, and power was up around 4-7kw at higher RPM levels. The newer results were used as the base for all comparison purposes to ensure we were comparing apples with apples for development purposes!

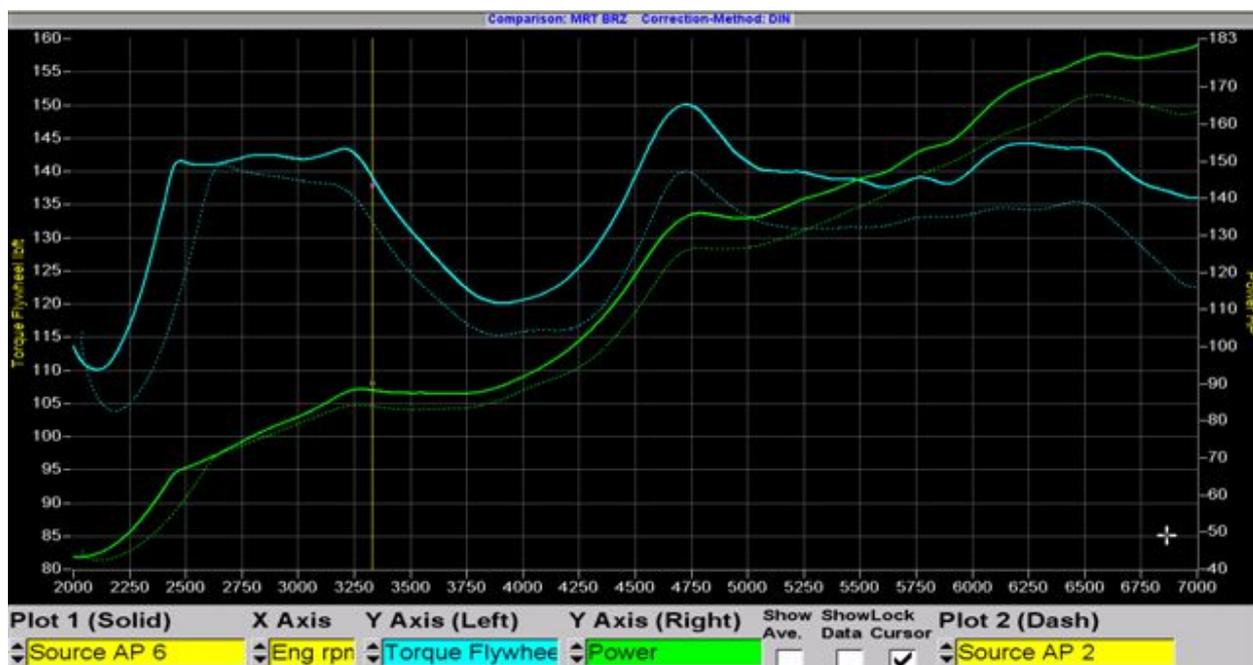
Much comment has been made on forums and elsewhere about the dip in torque through the mid range. While it stands out notably on paper in dyno graphs, it isn't quite as bad in real world conditions when driving. There are all sorts of interesting variations in the OEM engine mapping with regards to inlet and exhaust cam timing, ignition timing, fuel delivery and so on which looked responsible in the early stages of testing, however results showed that much of it is a result of Subaru and Toyota engineers calibrating things around the engines natural characteristics.



With extensive revisions to engine management calibration, the following was achieved on 98 RON fuel. We were able to yield some improvements in the level and duration of the torque dip, although we are currently testing mechanical upgrades (changes to inlet design and length, exhaust header design, etc) which should improve this further. Good gains in both torque and power were seen virtually right across the rev range, picking up as much as 10kw in places!



For our US based clients (or those local clients who have read information on Toyota 86 tuning from the US via the net or forums who want to compare results), this is what the numbers look like in lbf/ft/hp.



Subaru BRZ/Toyota 86 – XB Kit

With the maximum potential from the standard mechanical configuration achieved, upgrades to intake and exhaust design to improve air flow and engine efficiency are required.

At this point in time, we are presently mid way through development of a number of designs with results yet to be finalised. For further information please contact us.



Subaru BRZ/Toyota 86 – XC Kit

In conjunction with development of a number of intake and exhaust designs for the XB Kit above, we are also working in conjunction with several key component manufacturers on turbo and supercharger options for the BRZ/86. These will be fully integrated options designed to harness the best compromise between performance AND reliability and we fully intend to offer our factory warranty guarantee!

However due to the level of complexity, development is expected to take another month or two at the time of writing. Please contact us for further information if this level of upgrade is something you are considering.



Frequently Asked Questions

Do the modifications void my new car warranty?

(Also refer the details on the Factory Warranty Guarantee listed separately in this document)

One of the most common queries we get in relation to performance upgrades on new models is the potential effects on factory warranty. To that extent, Subaru retains the right to refuse claims on warranty where the item being claimed on has been modified or changed from factory specification.

However, to date we are yet to have any vehicle fitted with one of the MRT Power Kit upgrades fail as a direct result of the improvements made, with hundreds of kits supplied and fitted to date Australia wide. We also offer a warranty against manufacturer defect on all parts we supply. We also spend countless hours on research and development of parts, tuning, and the associated effects of these changes on the rest of the vehicle.

I have already made some modifications, can I get the same results as seen above?

A lot of customers perform modifications in stages, partly due to budget constraints and partly because it starts in stages and then the bug bites and performance becomes an obsession. All of the modifications listed above can be performed around what you already have. Depending on the quality and type of items fitted, we will get performance gains as close as feasible to the above. Of course to make sure you get the gains the vehicle is capable of, just make sure you use MRT parts from the beginning! 😊

Can I still service my car with a dealer?

We would like you to choose us for your regular servicing, but should you choose not to there are no hardware or software changes that will stop a Subaru dealer using their factory diagnostics equipment. Additionally if they reset your ECU it will still retain its “enhanced” settings.

If I have one type of kit, can I upgrade at a later stage if I want more?

Easily! All of our parts are designed to be compatible with other items. For example if you have one type of kit, upgrading to the next level simply consists of adding any additional parts that may be required (eg upgrading from a rear muffler only to a full exhaust system, updating ECU tuning to suit, etc).

The cost to upgrade depends on what parts you already have fitted. As a guide it’s generally around the difference in price between your kit and the next + any additional labour associated with the changeover that isn’t covered in the kit.

How long does the work take?

The XA (and more than likely the XB when ready) kits can be completed within 1 day. When booking your car with us (or your local authorised outlet) the total time your vehicle is required will be reconfirmed as well.

Where can I get the work done?

Any authorised MRT reseller can easily complete the above work for you, or assist in designing a series of modifications around your requirements. For further information and contact details please check out our website at

<http://www.mrtperformance.com.au/resources/mrt-partners-and-authorised-outlets>.

Of course if you have any other queries that we have missed, or need further information either give us a call directly on (02) 9767 4545 or get in touch with your local reseller.

7 Reasons why you can rely on MRT.

1. **Extensive R&D program** - each MRT Power Kit is the result of hundreds of hours of road and dyno testing. Different performance components are tested and retested to find an optimal solution to the question of “How can I cost effectively upgrade my car to be quick, reliable, economical AND fun to drive, without voiding my factory warranty?”

2. **Our Unique Triple Guarantee:**

i) **Guaranteed Performance Outcome** – We guarantee our kits will deliver at least our quoted figures for Power and Torque. You benefit from the hundreds of dyno tests we have performed to optimize our power kits and your car is individually tuned by our expert tuners to give you the best possible result.

ii) **Factory Warranty Guarantee** – Where our modified parts have been fitted to your car by us (or a reseller), should your new car warranty be voided as a result we will cover repair/replacement of any OEM parts negatively impacted by the modified parts under the same terms as the factory new car warranty.

iii) **Parts Guarantee** – All of the parts we supply are of high quality and covered by a full 6 month/ 10,000km warranty or for the life of your factory warranty, whichever is greater.

3. **Proven Track Record** – Why risk your money playing mix and match with components not designed to work together with no guarantee of a performance outcome or risk of engine failure? We have invested many hundreds of hours in developing each kit offered to find the best performance enhancement solution at realistic price points for you. Thousands of happy customers use their cars with our parts every day.

4. **How fast do you want to go** – Each kit has been designed specifically to suit your particular model car with different levels of performance based upon your budget and individual needs. Custom solutions are also available where required.

5. **Single Supplier** – if you encounter any issues, you have a single point of contact to get them resolved to your satisfaction. The possibility of vendors passing the buck and not accepting responsibility is eliminated.

6. **Improved Fuel Economy** – thousands of km of road testing has proven that your fuel economy will be as good as or better than prior to fitting the kit when the car is driven in the same manner under similar conditions.

7. **Drivability Focus** – our kits are not about massive outright power levels (although we can do this separately!), they are designed for practical enjoyment.

* For full details refer your MRT reseller and additional information within this document. MRT is independent of Subaru/Toyota.



XA Kit

Guaranteed minimum 6kW gain* (up to 8% more torque)

Includes:

- 1 x Factory Warranty Guarantee ***
- 1 x EcuTeK MRT ECU software upgrade
- 1 x EcuTeK Certificate of Authenticity
- 1 x Label kit, (1x petrol cap cover, 1x engine bay and 1x radiator support panel)
- 1 x EcuTeK embossed label
- 1 x Recalibration of factory ECU using mapping extensively developed on dyno and road **
- 1 x Full on road diagnostics and testing
- All labour to fit/tune/test vehicle

For pricing and more details refer to your local MRT Supplier



XB Kit

Under development, further details to come. Call for more information in the interim.

* Whilst realistic and achievable on all MY12 BRZ and 86 models, power gains are subject to 10% variation due to fuel quality and temperature variations in some areas of Australia. If you've concerns about any aspect of the work to be completed, please just ask us (or your local Authorised MRT Distributor)!

** Kits are NOT dyno tuned at time of fitment in most cases. We spend hundreds of hours on dyno and road at the development stage to eliminate unnecessary expense for you. This knowledge is incorporated in mapping designed for each kit, then refined in your car with road testing and diagnostics. Before and after power runs, or custom dyno tuning for every last kw are both feasible however additional costs will apply.

*** Refer Warranty details within document.