Flyin' Miata

Left Hand Drive (non i-Eloop) Installation guide for Flyin' Miata / BBR Turbocharger Conversion Mazda MX-5/Miata ND 2.0L 2016-2018

Contents

Introduction

Congratulations on your Flyin' Miata / BBR turbo conversion purchase, which will transform the performance of your Mazda! Please follow this guide to ensure a hassle-free installation. Should you have any queries relating to any part of the installation, please contact your distributor who would be happy to help!

Before attempting turbocharged installation, please ensure that your vehicle is in its very best possible mechanical condition and has been serviced in accordance to Mazda's schedules. If your car is misfiring or has any mechanical problems, such as a worn or slipping clutch, a turbo installation will only make them worse!

Flyin' Miata and BBR advises using only premium (91 octane +). Lower octane will only result in lower performance and possible engine damage! Before starting the disassembly process, we recommend that you pressure wash the engine bay - a clean working environment is far nicer.

We have made the installation of this conversion as simple as possible. No drilling or cutting of body work etc. required except for trimming of the under shield/wheel arch liners and the original intake scoop to allow intercooler pipe and BBR intake clearance. All BBR components are fitted based on removing and replacing the original part. Rather than listing every single procedure, nut and bolt size and having an installation manual the size of a bible, this guide is intended to provide the necessary instructions for a simple installation without any 'nannying'. It is expected that the installer will not be picking up a hand tool for the first time and be capable of jacking up, raising and supporting their vehicle in the correct and safe manner.

Due to the nature of adding a turbocharger to a non-turbocharged engine that uses a more basic method of adjusting speed with cruise control, some BBR Stage 1 turbo kit users have experienced a mild oscillation of power when cruise control is active while driving up a moderate to steep incline. The ECU thinks that the engine is still at the stock power level and because turbochargers build boost with load, the oscillation can occur when load is significant but the engine is only trying to maintain speed up the incline. Unfortunately, there is not currently a fix for this. We have found the best way to deal with this is to keep your foot resting slightly on the accelerator pedal or to simply turn off the cruise control feature when driving up moderate/steep inclines.

Please note that this is the first version of this installation guide and we will be updating this as required. Should you notice anything missing or inaccurate, please let us know as it will help with future DIY installations.

Tools and parts

Flyin' Miata and BBR recommend the following tools and parts for Mazda MX-5 ND turbo installation.

Required:

Metric spanner/wrench set 8-19mm
2 x 27mm spanners or large adjustable spanners
Metric socket set and extensions
T25 Torx socket
Screw driver set
Metric Allen keys
Side cutters
Pliers
Sharp Stanley knife
Jack and 4 x axle stands (ramp preferred)
Spray can of cleaning solvent/brake cleaner and clean rags
WD40 or similar spray lubricant
Thread sealant
2 x suitable clean containers to catch and refill engine oil and coolant
Spark plug gapping tool or feeler gauges

Optional:

Fresh engine oil/filter
Fresh antifreeze

Torque settings:

All required torque settings will be added to this guide promptly.

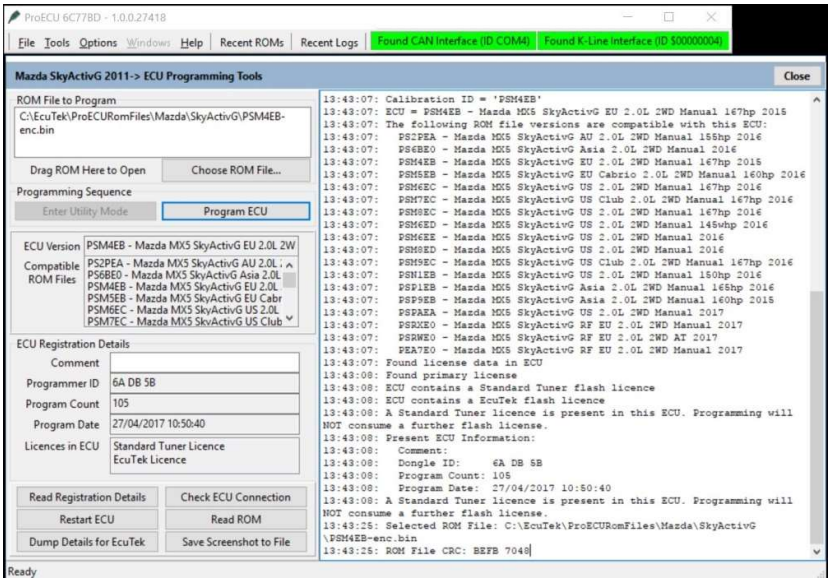
ND oil pan sump plug/adapter 23-30 lb-ft

Software Installation

Before any disassembly or starting the installation of your Flyin' Miata / BBR MX-5 turbo it is crucial that you have received your base Flyin' Miata / BBR turbo ROM file. Otherwise, Flyin' Miata and BBR will not be held responsible for you not being able to use your vehicle. On receipt of your conversion please follow the instructions within your EcuTek cable package, download and install EcuTek ProEcu from the link provided.

1. To receive your base Flyin' Miata / BBR turbo ROM file, your ECU version and dongle ID are required. Please follow the instructions below and send a clear screen shot to us at support@flyinmiata.com (making sure both dongle ID and ECU version are legible):

   With your vehicle's ignition on, engine not running and the OBD cable plugged in to the vehicles diagnostic port which is located under the steering wheel: Open ProEcu, select "Tools", "Detect Vehicle...", "Program Engine ECU". In the new opened window, select "Enter Utility Mode", take a screen shot of this window and the main tool bar, turn the vehicles ignition off and close ProEcu. Example screen shot as below:



Once your Flyin' Miata / BBR turbo base ROM file has been received and you are ready to perform the mechanical installation, position the vehicle in the desired position and program your Flyin' Miata / BBR ROM, **please note that your vehicle cannot be driven with the BBR tune but without the turbo kit installed or with the turbo kit installed but without the BBR tune. Before ECU programming** you will need to update your dongle with the required flash points. To download the flash points open ProECU, select Help > EcuTek Update, your flash points will be applied automatically to your dongle. For verification, select Help > Feature and License information… view Remaining Flash Points (the correct amount will have been allocated to your dongle, this will be 225 for MX-5/Miata models) select OK to close this window. To program the ECU: With Ignition on and cable connected, open ProECU, select tools > detect vehicle > Program Engine ECU > Choose ROM File (BBR file as sent) and then program the ECU by pressing 'Enter Utility Mode' first (when necessary) and then 'program ECU', follow instructions as directed.

Mechanical installation

Instead of repeatedly raising and lowering the vehicle, this section covers disassembly and installation at the same time. It follows the same procedure Flyin' Miata and BBR technicians would install this conversion on site. Read through this guide and familiarise yourself with the procedures outlined fully, before starting the disassembly of your MX-5.

Starting from underneath the bonnet:

1. Remove the strut top braces, battery (disconnecting negative terminal first), battery tray, air intake pipe, air box and coolant cap (Fig1).
2. Remove vacuum control module and bracket, remove the bracket from the vacuum control module, and cut and discard the now unused section with a cutting disc or hacksaw (Fig2). Bend the bracket as shown and install the bracket with the M6 nylon spacer, nylock and flange bolt from bag6. Secure wiring neatly with the supplied cable tie (Fig3).

Raise the vehicle and from underneath:

3. Remove all under shields, braces, the front portion of wheel arch liners and then disconnect the exhaust centre section lambda plug and remove the exhaust centre section (Fig4).

4. Remove the exhaust manifold support bracket, and **unplug and carefully remove the primary lambda sensor – this is delicate and will be reused** (Fig5).

5. Remove the horn in front of the radiator with its bracket, remove the right-hand side horn and install both in the existing right hand horn position. Note that the wire support clip supporting the wire to the radiator horn would need to be removed (Fig6&7).

6. Remove both air deflectors (2x bolts on each) (Fig8), and the two inner most chassis leg extension bolts from either side (Fig9).

7. Fit the Flyin' Miata / BBR intercooler re-using the 2x chassis leg extension bolts on either side (Fig10).

8. Into a clean container undo the radiator drain and drain the coolant (this can be re-used). Once all coolant has drained re-tighten the radiator drain (Fig11).

9. Use WD40 or similar to install all silicone couplers and aluminium pipes in to the couplers as they are extremely tight and the lubricant will allow easier installation and positioning. Install the 90 degree 57mm silicone coupler to the intercooler outlet (intake engine side) and the 57mm curled aluminium pipe. A 50-70mm hose clamp is used on both sides; position the pipe as shown in Fig12 and Fig13. To ensure that the aluminium intercooler pipe does not rub or touch on the bottom water hose, it is recommended that the bottom water hose is shortened by 10mm on the radiator connection and positioned away from the intercooler pipe. **Later turbo kits come with single piece silicone intercooler hoses (not shown).**

10. Remove oil pressure sensor and from bag 3 install the oil pressure switch adaptor, turbo oil supply line adaptor and re-install the oil pressure sensor using a suitable thread sealant. Position the adaptor so that the turbo oil supply line will clear the thermostat housing (Fig14) and remove the engine mount nut (shown removed Fig16).

Lower the vehicle and continue work under the bonnet:

11. Install the 57mm humped coupler hose to the curly aluminium intercooler pipe using a 50-70mm hose clamp (Fig13) and remove the battery negative terminal supporting clip from the side of the fuse box. **Later turbo kits come with single piece silicone intercooler hoses.**

12. Remove both of the heater matrix hoses/pipes that connect to the bulkhead. The steel pipe requires removing completely; leave the rubber heater hose connected to the engine following removal of the steel hard pipe and its bracket. Re-use the rubber mount/supporting bracket for the air condition pipe as shown with steel hard pipe bracket bolt. Please refer to Fig25.

13. Place a jack under the sump and carefully (with a flat jack top or hard wood packer) raise the exhaust manifold side of the engine 20-30mm (this will aid exhaust manifold removal) and remove the exhaust manifold heatshield (Fig15).

14. Remove the exhaust manifold and the centre most exhaust manifold stud. From bag 4 install one of the nine M10 studs (shorter finer threaded M10x1.25 end) into cylinder head (Fig16). We recommend locking two M10x1.5 nuts together to avoid thread damage for all stud removal and installation (use the downpipe to centre section nuts for this).

15. On a suitable bench, install the remaining 8 studs to the turbine housing inlet and outlet (Fig17). From bags 3 & 5, install the straight end of the oil drain hose onto the oil drain adapter. Line up the 90-degree fitting on the other end of the oil drain hose lines up with one of the flanges of the adapter. Install the oil drain adaptor with gasket with the two M6 pan head Allen bolts making sure the 90-degree outlet points toward the head face. (Fig18).

16. Using the supplied gasket and four M10 stainless locking nuts (bag 4) install the turbocharger to the Flyin' Miata / BBR cast manifold. Please note that due to clearance, the inside (closer to head) nuts must be started first.

17. Install the turbocharger and manifold assembly to the cylinder head (re-using the original exhaust manifold to the head gasket) guiding the oil drain hose towards the sump plug drain. Due to clearance, the central manifold to cylinder head nut must be installed first using the copper locking nut supplied in bag 4. In all other positions, re-use the original manifold to head nuts. Tighten the manifold to head nuts evenly from the centre outwards (Fig19).

18. Within the silicone coupler bag there are three lengths of heat reflective tape. With brake cleaner or similar, clean the existing small heat shield covering the brake pipes and fix the three lengths of heat reflective tape on top (Fig20).

19. Lower the jack on to the rubber engine mount ensuring that the stud is in the correct position, remove the jack and reinstall the engine mount nut. Using the gasket and remaining four stainless M10 locknuts install and tighten the downpipe to the turbocharger. Note that it is far easier to feed the downpipe into position and on to the turbo studs from underneath (Fig19).

20. Install the turbo outlet pipe using the sealing O-ring and two M8 pan head Allen bolts from bag 4 (Fig21).

21. Using 2x M14 banjo bolts and 4x M14 copper sealing washers (bag 4) install the 2x stainless steel turbo water hoses (bag 3) to the turbo, see Fig22 for routing. Using original hose clamp, install the 270mm x 17mm heater hose to the lower heater matrix pipe on the bulkhead. Route the 17mm hose neatly underneath the A/C pipe to join again to the heater hose at the front of the engine (where original hard steel water pipe was previously removed). Using a metal T-piece and length of 8mm heater hose (bag 3) along with 2x 8-16mm and 2x 20-32mm hose clamps, join the inside (closest to engine) stainless turbo water hose and re-join the heater matrix hose. Note: it will be necessary to neatly trim the supplied 8mm and 17mm hoses to the correct length using a Stanley knife, routing the stainless turbo water hose away from the turbine housing and exhaust manifold (Fig22).

22. Fit the 63mm straight silicone coupler to the turbo inlet with a 60-80mm hose clamp. **Later turbo kits come with a single piece silicone turbo inlet hose between the turbo and the 180-degree MAF pipe.** Re-fit the original heater matrix to water pump hose to the lower heater matrix pipe on the bulkhead and trim as shown (Fig22). Fit the supplied 19mm 90-degree water hose (bag 6) to the heater matrix water pump outlet with original hose clamp. Re-join the heater matrix/water pump 19mm hose, using the remaining metal T-piece and with the length of 8mm heater hose the outside stainless turbo water hose (bag 3). Join the hoses with 2x 8-16mm and 2x 20-32mm hose clamps. Note: it will be necessary to neatly trim the supplied 8mm and 19mm 90-degree hoses to the correct length using a Stanley knife, again routing the stainless turbo water hose away from the turbine housing and exhaust manifold (Fig22).

23. This step is not mandatory, however is recommended to aid clearance for the new air filter. Using a Stanley knife, trim the intake pipe (removal from vehicle is not necessary) to remove the 10mm larger diameter lip (Fig23).

24. Remove the mass air flow meter (MAF) from original air box lid and reusing the screws to install it to the Flyin' Miata / BBR 180-degree MAF pipe. **The O-ring will require sliding up the MAF meter as it will now be sealing on the base (not inside the bore as previous)** (Fig24).

25. From bag 5, install the 3-hole flat stainless-steel mounting bracket to the filter and M6 rubber mount with flanged nylock to the mounting bracket. With the 70mm straight silicone coupler and 2x 60-80mm hose clamps join the 180-degree MAF pipe to the filter (largest side). On the other side of the MAF pipe install the 63mm hump hose with 1 x 60-80mm hose clamp. For now, **leave all the hose clamps loose** (Fig24).

26. Move the inner most earth strap on top of the outside earth strap and with the spare bolt install the 2-hole L-shape mounting bracket as shown in Fig26.

27. The air filter and MAF assembly can now be installed, with a 60-80mm hose clamp (leave loose) install the aluminium turbo inlet pipe to the turbo inlet. **Later turbo kits come with a single piece silicone turbo inlet hose between the turbo and the 180-degree MAF pipe.** The MAF pipe rubber mounting stud slots into the previously installed L-shape bracket and is fixed with the remaining M6 nylock flange nut (bag 5). The 63mm humped hose connects to the aluminium turbo intake pipe with a 60-80mm hose clamp. **Before any hose clamp or nut tightening,** position the air filter so that it will not rub on the radiator or fan wires, position the MAF meter so that it has sufficient clearance from the radiator expansion bottle, and position the aluminium intake pipe so that it will not rub on the top radiator hose. Once the intake assembly is positioned correctly and square, tighten the M6 nylock and the 5 hose clamps. **Note that the hose clamps to the MAF pipe must not be over tightened** (just nip these clamps) as over tightening will crush and damage the MAF pipe (Fig27).

28. Install the battery tray (bag 2) using the 2x M8 countersunk Allen bolts and 12mm spacer (Fig13) as shown in Fig28. Place the battery in position (positive terminal toward the driver side. Different battery pictured). Remove some of clips from the ground wire to gain sufficient reach to the negative battery post. Unbolt the clamp portion of the positive battery terminal and install the supplied battery bar and protective cover in between the terminal clamp and the fuse block. Leave both battery terminals disconnected for now. Fix the battery with the supplied U-bolts, clamps, nuts and washers (Fig29).

29. Install the straight reducing coupler to the throttle body with a 60-80mm hose clamp and the throttle body to intercooler aluminium pipe using 2x 50-70mm hose clamps. **Later turbo kits come with single piece silicone intercooler hoses.** Position this pipe carefully allowing plenty of clearance from the top of the battery and ensuring that the curly aluminium hose is not being pushed into the side of the battery or bottom water hose (Fig29).

30. From bag 6, install the recirculating dump valve with 4x 20-32mm hose clamps and the 2x lengths of straight 25mm silicone hose. Using a Stanley knife neatly cut the inlet manifold to brake servo vacuum hose, install the 10x6x10mm plastic T-piece and route the silicone vacuum pipe neatly to the dump valve (Fig30).

31. Replace the OEM manifold absolute pressure (MAP) sensor with the Flyin' Miata / BBR MAP sensor from bag 5. This is a tricky procedure due to the MAP sensor location. It is located at the rear of the manifold and secured with a T25 Torx bolt (Fig31).

32. With extreme use we have found the unsecured PCV/breather hose to disconnect from the underneath of the inlet manifold. Whilst it is difficult to access, please install the supplied spring clip (bag5) to the PCV/breather manifold hose connection (Fig38).

33. From bag 3, install the breather to intake 10mm hose with 2x 8-16mm hose clamps and supporting P-clip. With the M12 banjo and 2x M12 copper washers, install the turbo oil feed line routing towards the oil pressure switch adaptor away from both the turbine housing and actuator rod (Fig32).

Raise the vehicle and from underneath:

34. Join the turbo oil supply line to the oil supply line adaptor (Fig33), install the primary lambda sensor to the down pipe (connect to vehicle loom) and re-using original manifold support bracket and bolts, Install the support bracket to the downpipe (Fig34).

35. Re-install the exhaust centre section, fixing it to the downpipe with the supplied M10 nuts and bolts, re-using the copper sealing ring. This can be kept in place in the centre section with exhaust paste or grease while joining to downpipe (Fig35). Be sure that the rear / post-cat O2 sensor (in the front of the exhaust centre section) remains in place and isn't damaged.

36. Fit the final intercooler pipe. **Later turbo kits come with single piece silicone intercooler hoses.** Use a 90 degree 57-51mm reducing silicone coupler on the inlet side of intercooler with a 50-70mm hose clamp. Use a 90-degree 51mm silicone coupler with a 40-60mm hose clamp on the turbo outlet pipe, and then install the 45-degree 51mm aluminium pipe with 2x 40-60mm hose clamps. Position this pipe away from the hard plastic water hose and the power steering motor (Fig36).

37. Remove the sump plug and drain the oil (into a clean container should you wish to re-use the oil). From bag 3 install the oil drain adaptor with a M14 copper washer to the sump (torque to 23-30 ft lbs), supporting this adaptor attach and tighten the oil drain line to the sump adaptor (Fig37).

Lower the vehicle:

38. Re-fill the engine coolant from the water outlet filler neck until it is close to the top of the water outlet filler neck. Fill the coolant reserve tank up to the FULL mark on the tank. Refill the previously drained engine oil, or if using new oil fill 4.1 litres without filter, 4.3 litres with filter. Remove the spark plugs and reduce their gap to 0.8mm (0.032”). Be careful not to damage the tip of the electrode in the process. Failure to properly gap the spark plugs can result in misfire issues.

39. Install the battery terminals (positive first); remove the fuse box lid and central most fuel injector main relay (Fig39). For oil pressure and to fill the turbo oil supply line, crank the engine for 20 seconds, this is done with the normal start procedure, release the clutch pedal to end engine cranking.

40. Reinstall the injector relay and fuse box lid, and check the oil and coolant level. Start the engine and check for any oil or coolant leaks. To prevent any cooling system air locks (with the cooling system cap still removed) start the engine. Turn on the heater (full heat) to the windscreen and run the engine at 2,500 rpm for approximately 5 minutes. Once hot air has been expelled from the heater for a couple of minutes allow the vehicle to idle and install the cooling system cap. Maintain the engine speed at 3,000 rpm for approximately 5 minutes, and then while the engine is idling check for any coolant or oil leaks. Turn off the engine and address any leaks should they be present.

Raise the vehicle for the last time:

41. Refit all previous removed under shields, braces and the front portion of wheel arch liners with original fixings. The main under tray and wheel arch liners will require neatly trimming to clear the intercooler pipe work (Fig40,41,42).

42. Lower the vehicle and with a cool turbo/exhaust system install the turbo heat shield. Remove the 4 cam cover bolts and the M6 flange bolt from the turbo compressor heat shield bracket. Hold the shield loosely in place and partly install the M6 flange bolt. Start the 4 cam cover bolts, tighten and then tighten the M6 flange bolt. Note when installing the shield to ensure that the heat tape does not catch on the cam cover and sits on top to the cam cover mated to the shield.

43. With the turbo heat shield in place, inspect the proximity of the A/C hardlines to the heatshield and the turbo compressor housing. If the A/C lines are at all close, gently pull them away to adjust their resting position to have at least 10mm of gap.

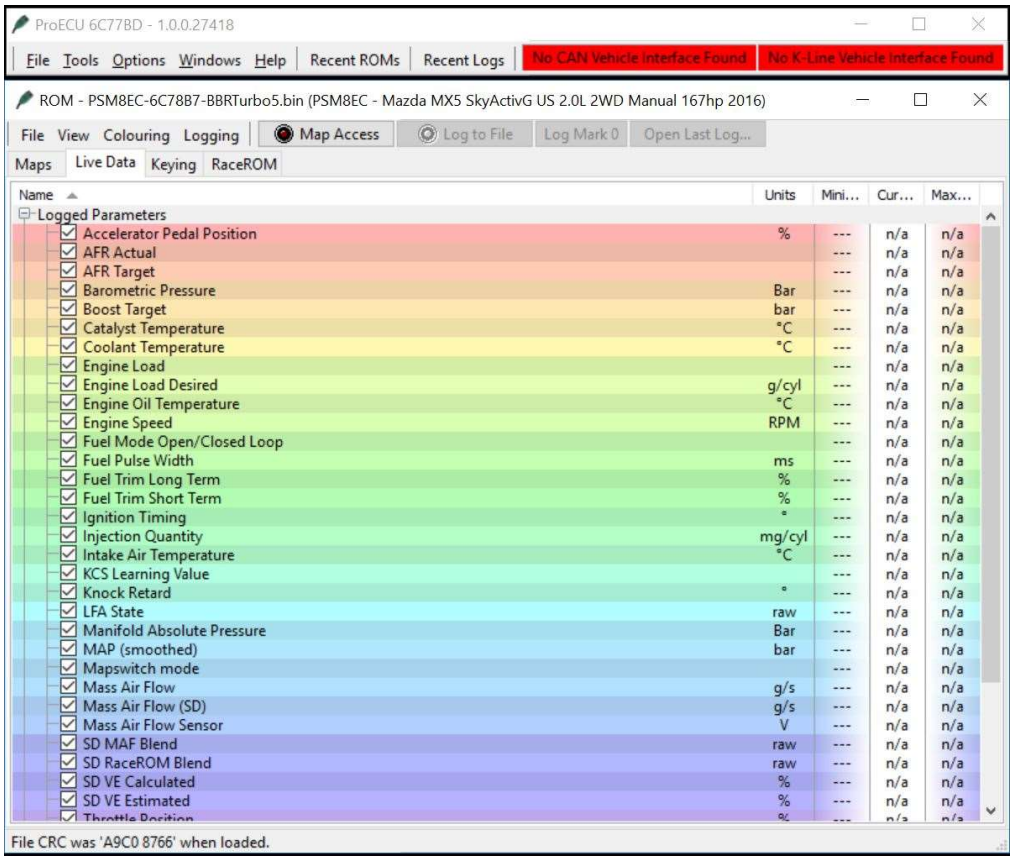
44. To finish all mechanical work, re-install the strut braces with original fixings.

Data logging

Open ProEcu on the main tool bar select “Open ROM File…” and open the Flyin’ Miata / BBR ROM file previously installed. With the engine running and cable installed to the vehicle’s OBD port, select “Map Access” – this will show the live data, then select “Log to File” to begin and end logging. We require a log showing idle, part throttle running and a full throttle log in 3rd gear or higher, from 2000-7000RPM. When performing the full throttle log, it is imperative that “AFR Actual”, “Knock Retard” and “Manifold Absolute Pressure” are closely monitored. **Should the AFR value be above 12.5, MAP above 1.5 or knock retard have values lower than -2, lift off immediately!** The same goes should there be any audible detonation, unusual mechanical sounds or hesitancy/misfiring. You’ll also need to include a few extra parameters with your datalog files so that we have more information about what’s going on. When you send us datalogs for review, please be sure to include the following additional parameters with your logs (if not already selected):

Gear
Mass Airflow final
Mass Airflow desired
Throttle Limit
Throttle Position desired
Throttle Position Relative
Torque Actual
Torque desired

These parameters are included in the big list of PIDs when looking at the Datalog screen. Log files can be opened by selecting “File”, “Open Log File…” on the main ProEcu menu. The Log files can also be copied and pasted from the file opening window. Please submit the log file (or files) to Flyin’ Miata and refrain from further full throttle/high load driving until you receive correspondence from Flyin’ Miata.



Tuning

The tune for the Flyin' Miata / BBR Turbo kit is locked for the purposes of safe operation and CARB compliance. However, those living at higher elevations may wish to increase the turbo RPM to get closer to the performance that would be seen at sea level - since air is thinner at elevation than at sea level, the turbo will produce less boost and the engine will produce less horsepower as-is. This can be corrected (mostly but not completely) by increasing the turbo RPM. When a turbo car (without closed-loop electronic boost control) is driven at higher elevation (i.e., lower ambient air pressure / thinner air), the manifold pressure will be lower than what it would be if the car were driven at sea level. For example, at sea level, 7 psi gauge pressure (i.e., pressure above ambient) will result in the ideal 145 kPa of absolute manifold pressure, whereas at 5000ft it would drop to about 5.5 psi (128 kPa). There's nothing outright wrong with that, although you'll make less power than you should / could. If you *live* at a higher elevation (there's no reason to worry about this if you drive briefly at higher elevation) and wish to increase the boost level, you will need to either purchase and install a boost controller or shorten the wastegate actuator rod slightly to increase the wastegate actuator spring pressure. The wastegate actuator rod is the cheapest (free!), but it's also the highest effort and the biggest pain to revert back. It's also very awkward to access on the Flyin' Miata / BBR turbo kit. Flyin' Miata offers both electronic and manual options on our website, both of which are dramatically easier (the electronic offers better performance, the manual is easier to set up and change). Either install the boost controller and set it at its base (lowest) setting, or shorten the wastegate rod slightly, and go out driving with the ProEcu software, monitoring the manifold absolute pressure (MAP) as well as AFR Actual and Knock Retard (which are all critical for safe engine operation). **Should the AFR value be above 12.5, MAP above 150 kPa, or knock retard have values lower than -2, lift off immediately!** Make adjustments to the boost controller or wastegate actuator rod until the target of 145 kPa is achieved.

If you have made any adjustment to your boost level and plan to drive your car down in elevation, it is imperative to decrease your boost before going for a drive to ensure you do not over boost while at a lower elevation!

This concludes the Flyin' Miata / BBR Turbo installation guide for Mazda MX-5 2.0L ND models. We hope that you have enjoyed your installation and that your turbocharged BBR MX-5 gives you many years of pleasure and surpasses your expectations. Welcome to the fast lane…

Remainder of page left intentionally blank for notes:

Installation diagrams

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

Figure 8

Figure 9

Figure 10

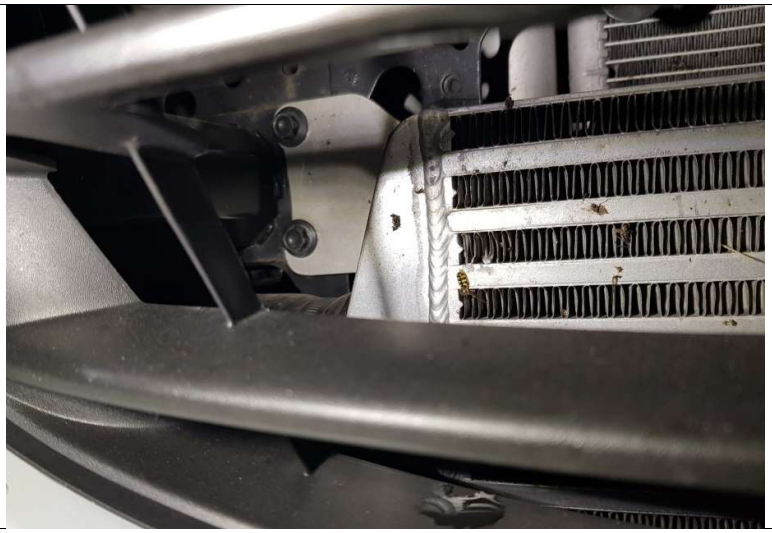


Figure 11

Figure 12

Figure 13

Figure 14

Figure 15

Figure 16

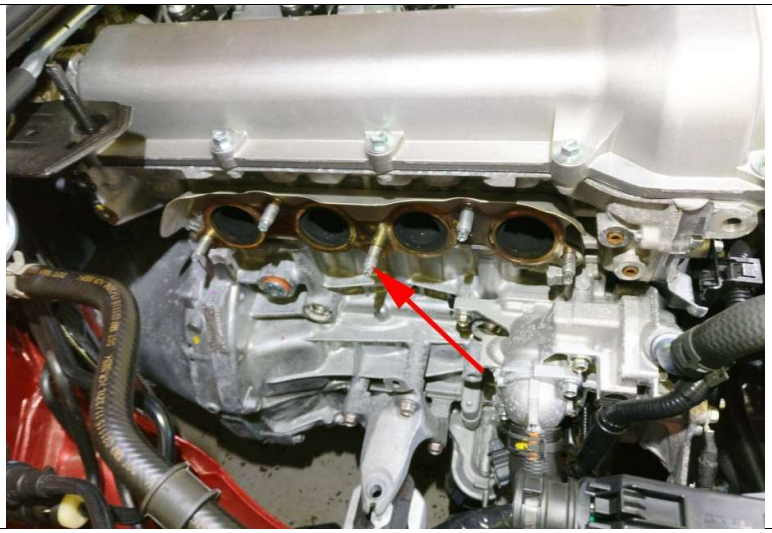


Figure 17

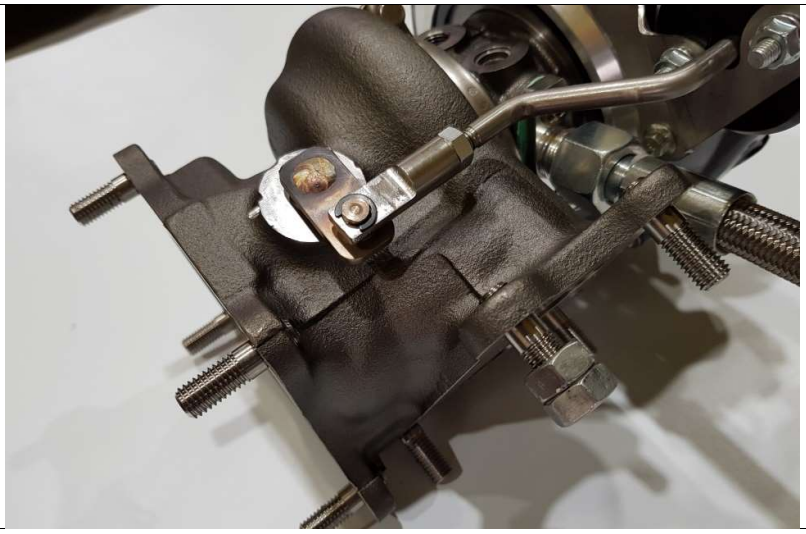


Figure 18

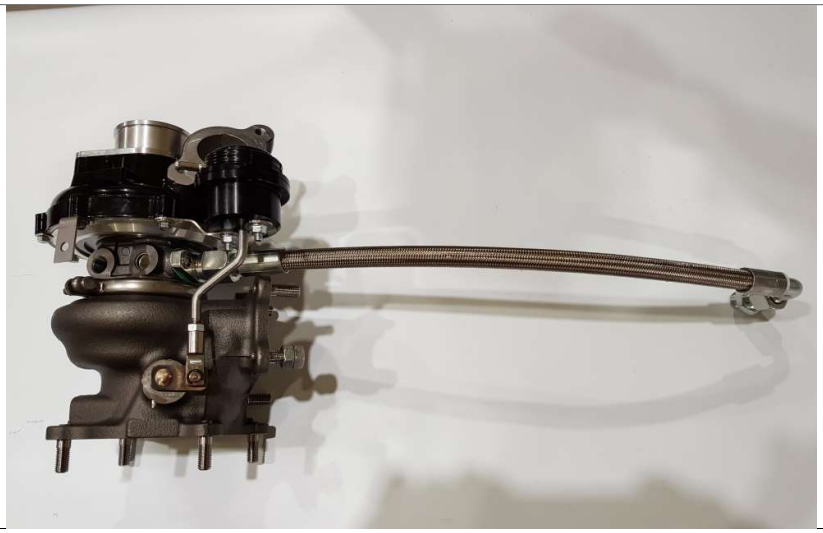


Figure 19

Figure 20

Figure 21

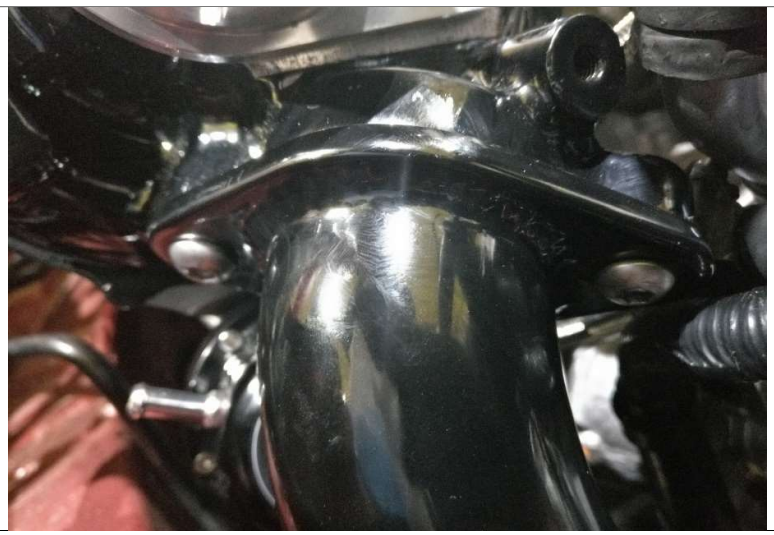


Figure 22

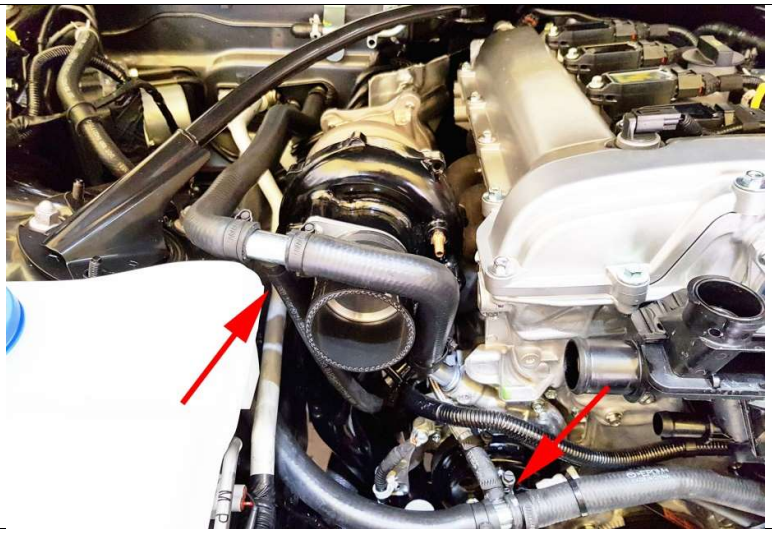


Figure 23

Figure 24

Figure 25

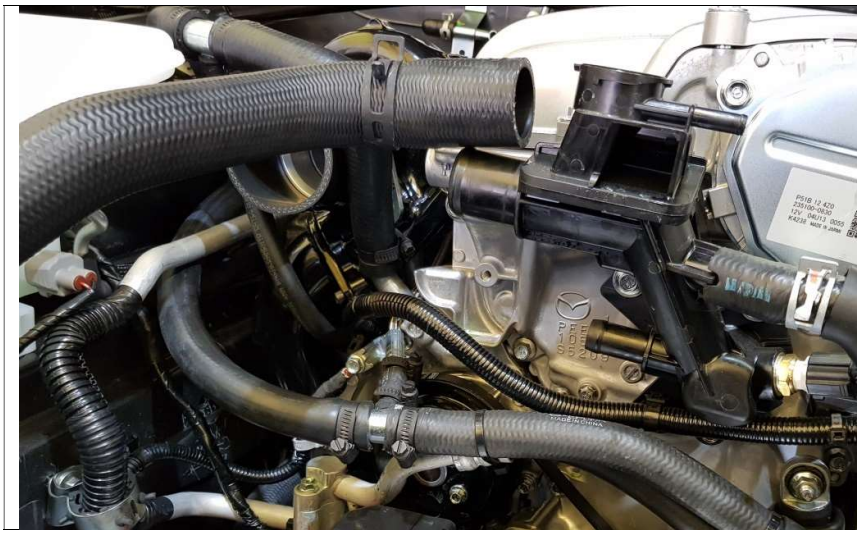


Figure 26

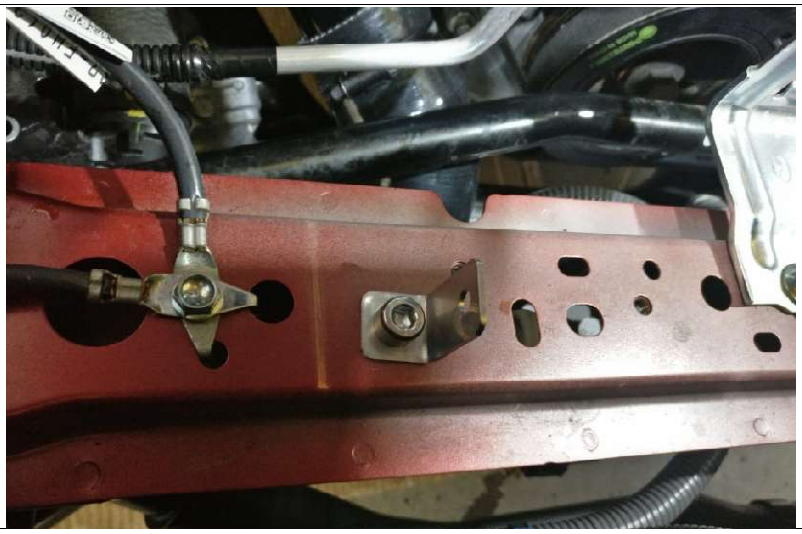


Figure 27

Figure 28

Figure 29

Figure 30

Figure 31

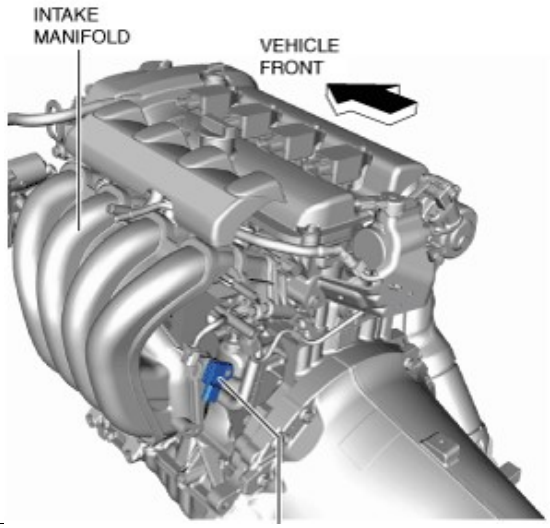


Figure 32

Figure 33

Figure 34

Figure 35

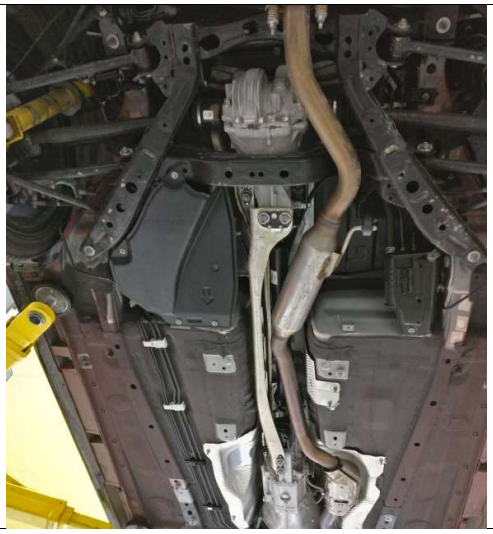


Figure 36

Figure 37

Figure 38

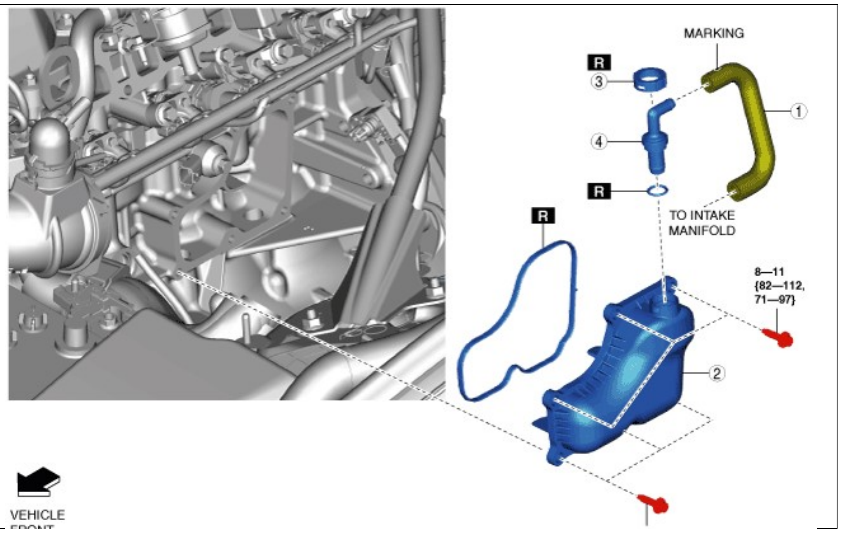


Figure 39

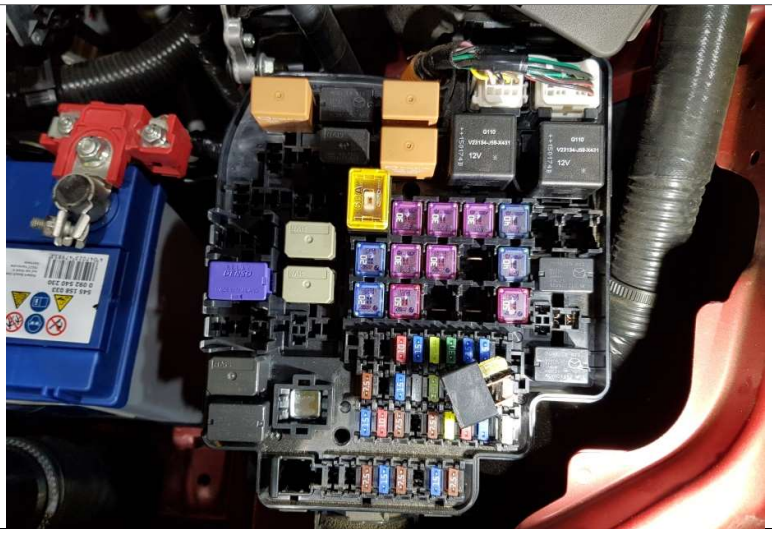


Figure 40

Figure 41

Figure 42