Volume

## XS ENGINEERING, INC. Department of Research & Development

# PowerMax Turbo System: 1993-95 Mazda RX-7

DEPARTMENT OF RESEARCH & DEVELOPMENT

# PowerMax System: 1993-95 Mazda RX-7 Installation Manual

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#### Introduction

Thank you for purchasing the XS Engineering PowerMax System for the 1993-95 Mazda RX-7 (FD3S). This system has been designed by XS Engineering's Research and Development Team to complement the RX-7's sturdy yet agile chassis by adding a healthy dose of *raw turbocharged power!* By taking advantage of Mazda's potent 1.3-liter 13B-REW rotary engine, XS Engineering bends the laws of physics once again by designing a single turbo system that delivers both immediate boost response *and* 368 Dynojet-proven horsepower to the wheels at only 13.5psi! Aside from this, please take the time to read through and understand this manual fully before you proceed with the installation process.

### Preparation

Please bear in mind that the proper conversion from a sequential turbocharger setup into a single turbocharger one is no easy task. This is the reason why we ask that only experienced professionals install this turbocharger system. In addition, we strongly suggest that this turbocharger system only be installed on engines that are in good condition. Please inspect the following:

1. Cooling system – make sure that this is within or better than factory specifications.

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- 2. Ignition system make sure that this is within or better than factory specifications and that the ignition timing is stock.
- 3. Fuel delivery system make sure that the fuel pump, fuel filter, and fuel injectors are all working within factory specifications. Also, make sure that the fuel used is at least 91 octane or higher.
- 4. Engine compression make sure that the engine's compression is within factory specification.

#### **Recommended Parts List**

- 1. PowerFC Engine Management System it is imperative that you tune your vehicle's fuel injection system to match your new turbocharger system. We recommend using the A'PEXi PowerFC and FC Commander. You may also need upgraded injectors and fuel pump depending on your desired horsepower level. Another benefit if the PowerFC is that it will allow you to remove the majority of the remaining solenoid s and associated vacuum lines that reside underneath the intake manifold.
- 2. Intercooler Upgrade we strongly suggest that you upgrade to a frontmounted intercooler.
- 3. Spark plugs we suggest BUR7EQ for the leading plugs and BUR9EQ for the trailing plugs. These are what we have found to be the most suitable for this type of application and can be obtained from us or directly from your local Mazda dealer. Certain applications, especially rotaries that are more radically tuned, may benefit from even higher performance racing spark plugs. If you fall under this category, call our office for more information.
- 4. Spark plug wires the factory plug wires are insufficient at elevated horsepower levels. You must upgrade to a high-performance wire like Magnecor or equivalent.
- 5. Ignition amplifiers these are highly recommended at elevated horsepower levels for those of you who will be using factory ignition coils. We recommend the XS Engineering Power Pack Ignition Amp.
- 6. High quality boost meter one that reads in PSI would be ideal as the target boost pressure range is 9psi to 11psi.

- Turbo timer extends the life of your turbocharger by allowing it to cool down before shutting off the engine. We recommend the new A'PEXi Timer for its ease of use and ease of install into the FD3S.
- Clutch or torque converter upgrade the elevated horsepower levels that your engine will generate with this turbocharger system will warrant the use of a high performance clutch such as an ACT unit on M/T equipped cars. Contact us for information. On A/T equipped vehicles, contact Level 10 for their transmission upgrade services.
- 9. High performance exhaust system we suggest the A'PEXi N1. It is the exhaust system that we have had the most success with on the turbocharged FD3S/13B-REW platform.
- 10. Oil Cooler the oil in a turbocharged vehicle undergoes much greater thermal stress. The addition of a high performance oil cooler system will benefit all of the oiled components in your engine including the turbocharger itself.

# Turbocharger System Installation

Please follow the directions below carefully, making sure to perform each step in its listed order. We would like to stress to you that, when the directions call for you to remove or install any of your vehicle's factory components, you must follow the instructions given in your factory service manual. Let's begin.

- 1. REMOVAL Refer to factory manual for step-by-step removal instructions.
  - a. Disconnect the battery.
  - b. Drain oil and coolant.
  - c. Remove the downpipe.
  - d. Remove factory airbox.

- e. Remove air pump and belt and leave the electrical connection to air pump disconnected.
- f. Remove metal vacuum tubing *(use Xerox picture, p. C-34 in manual).*
- g. Remove the plastic pressure chamber located behind the alternator.
- h. Remove factory turbochargers & exhaust manifold. Make sure to disconnect the factory O2 sensor and save it for later use.
- i. Notice that the front factory turbo employs the use of a 2-piece oil drain line. Only remove the top side (flexible portion). Leave the bottom section attached to the engine.
- 2. Clean and inspect factory exhaust manifold gaskets, nuts, and studs. You should be able to reuse them. If not, then purchase new ones from the Mazda Dealer.
- Replace the heater core tubing and hose (runs between the lower radiator hose and firewall) with the supplied silicone unit (5/8"ID x 40.5") and use #12 hose clamps x 2 to secure. Route this hose like it is shown on the picture to the right.
- 4. Block off the rear oil-return port with the supplied <u>2-bolt flange</u>. The factory gasket is metal and should be able to be reused. If not, replace as necessary.
- 5. Install the supplied <u>turbo oil drain tube</u> onto the remaining factory front turbocharger oil drain section described in step 1, section i. Use the factory nuts, bolts and gasket if they are reusable.



Otherwise, you can purchase a new fasteners and gaskets directly from the Mazda dealership.

- 6. Pre-assemble your new <u>turbocharger</u> to the supplied <u>exhaust manifold</u> using <u>M10 studs x 4</u>, <u>M10 flanged nuts x 4</u>, <u>M10 lock washers x 4</u> and <u>T4 stainless turbine inlet gasket x 1</u>.
- 7. Install the supplied <u>HKS Racing Wastegate</u> to the turbocharger and manifold assembly and orient it so that the discharge will point towards the passenger-side of the car. Use the HKS supplied fasteners and gasket.

- Next, install supplied <u>3/8"ID x 6.5" length silicone heater hose</u> to the passenger-side coolant fitting of the turbocharger using <u>#6 hose clamp x</u> <u>1</u>. Leave the other end of the 3/8"ID hose open to be installed in a later step.
- Optional If you already have a Greddy Pulley Kit, or equivalent, installed that bypasses the smog pump, skip to Step 11. Otherwise, you will need to either install the Greddy Pulley Kit or the optional <u>water pump belt</u>. Both of these items can be purchased at XS Engineering, Inc. Make sure to tension it as you would the factory belt.
- 10. Install the turbocharger, manifold, and wastegate assembly at this time. Make sure to use the factory exhaust manifold nuts (4) and gaskets. *Tip: remove the EGR valve that is located on the extension housing prior to turbo installation.* Remember to reinstall this part after you have completed turbocharger *installation.*
- 11. Install the supplied oil and coolant lines.
  - a. Oil drain = fasten <u>oil drain flange/fitting</u> to turbo and then connect <u>3/4"ID x 5.0" super-stock hose</u> (black) for oil drain. You may need to cut this hose for it to fit properly. Use <u>#8 hose clamps x 2</u> to secure this line. Also, make sure to wrap this line using the supplied <u>reflective heat wrap</u>. Use only as much needed to wrap the hose once around. *Tip: It is advisable to wear gloves during this procedure to avoid the possible skin irritation associated with handling this type of heat reflective wrap.*
  - b. Oil in = connect the supplied <u>steel-braided oil inlet line</u> between the factory oil supply line and the oil inlet port on the turbocharger. This line is designed to have a 270° loop prior to the turbocharger. Make sure that there are no crimps in this line. Note that the factory oil supply line will have to be slightly redirected towards the front of the vehicle. Refer to picture in step 3 above.
  - c. Coolant lines = use the supplied <u>3/8"ID x 15.0" silicone hose</u> to connect the turbocharger's passenger-side coolant fitting down to the factory coolant pipe located on the aluminum radiator pipe. Finish connecting the driver-side coolant line (step 8) to the upper factory coolant nipple located on the front cover of the engine. Fasten these hoses using the 3 remaining <u>#6 hose clamps</u>. Wrap the turbo side of these lines with <u>reflective heat wrap</u> as well.
- 12. Secure the 5/8"ID silicone heater hose that you installed in step 3 along with the AC line next to it and wrap both with the supplied <u>heat</u> reflective wrap in the areas around the turbocharger's turbine housing.

Tip: It is advisable to wear gloves during this procedure to avoid the possible skin irritation associated with handling this type of heat reflective wrap.

- 13. Install the supplied <u>turbine housing heat shield</u> at this time and secure it using safety wire.
- 14. Prepare the supplied <u>downpipe</u> for installation by wrapping it with the supplied Thermo-tec heat-insulating wrap. *Tip: Thermo-tec works best when it's moistened before you apply it. It is advisable to wear gloves during this procedure to avoid the possible skin irritation associated with handling Thermo-tec.*
- 15. Next, install the supplied <u>downpipe</u> and <u>3.0" gasket</u>. Use <u>M10 x 35mm</u> <u>x 4, M10 lock washers x 4</u>, and <u>M10 flanged nuts x 2</u>. Now, reinstall the factory O2 sensor onto your new downpipe.
- 16. Install the **wastegate dump tube** using the HKS supplied gasket and fasteners. The wastegate dump tube should point towards the rear of the vehicle.
- 17. Vacuum cap installation. Install these vacuum caps in the respective places shown in the pictures below.
  - a. Install the <u>7/8"ID vacuum caps x 2</u> over the secondary air pipes and secure in place using the factory spring clamps. *(picture)*.
  - b. Install the <u>medium vacuum caps x 2</u> and secure using <u>zip ties</u>.
  - c. Install the <u>small vacuum caps x 6</u> and secure these using supplied <u>zip ties</u>.





- 18. Install the supplied <u>lower intercooler pipe</u>. Use the supplied <u>2.0" to 2.5"</u> <u>silicone transition hose</u> and fasten this using <u>#36 hose clamp x 1</u> and <u>#40 hose clamp x 1</u>. Notice that there is a bracket attached to this pipe. Fasten this bracket to where the factory air pump was attached utilizing the factory nut and long bolt.
- 19. Mount the supplied **A'PEXi Twin Chamber BOV** onto the intercooler pipe so that its top is pointed towards the passenger side. Fasten this unit using the A'PEXi supplied allen-head bolts x 2 and gasket. \*Note: for high boost applications, it is recommended that you remove the 6mm hose that joins the two side ports on the BOV. Make sure to plug the lower port (closest to the mounting flange) with a vacuum cap and secure it with a cable-tie. If the 6mm hose is left connected, the BOV may open prematurely at boost levels above 14psi.
- 20. Installing the intake:
  - a. Street Kit Install the supplied <u>3.0" intake pipe</u> and <u>air filter</u> <u>assembly</u>. Use the supplied <u>3.0" silicone connector</u> hose and <u>#48 hose clamps x 2</u>. Make sure that the <sup>1</sup>/<sub>4</sub>" barb on the intake pipe points towards the driver-side and that the air filter is clocked in such a way so that it does not touch anything.
  - b. Strip Kit Due to different space or filtration requirements of highly modified vehicles, the air filtration system design is left up to you. While a small amount of horsepower can be gained by running the turbocharger without an air filter, doing so will most likely shorten the service life of that turbocharger.

- 21. Install vacuum lines between the following locations. Remember that each hose must be cut to a suitable length and fitted such that sharp turns and contact with exhaust manifolds and turbine housings is avoided. See *picture below*. Also, we have already installed a <sup>1</sup>/<sub>4</sub>" fitting into the sideport of the wastegate. This is the only port that is required for this turbo kit to function properly. However, some boost controllers may require that you add a fitting to the top-port. Consult with the instructions that come with your boost controller for details. The top port is threaded for 1/8" BSP.
  - b. intake pipe to breather (Street Kit only)
  - c. BOV to intake manifold
  - d. IC pipe to wastegate side-port
  - e. IC pipe to oil injection vacuum line "T' into injector air bleed socket.



#### **Final Systems Check**

Now that the PowerMax System has been fully installed, we will now perform some preliminary 'shakedown' procedures to ensure that everything is functioning properly.

- 1. Double-check every fastener and connection to make sure that every hose clamp, fitting, nut, and bolt is properly tightened.
- 2. At this time, refill your engine with both oil and coolant. Make sure to use high quality mineral oil.
- 3. Perform a visual inspection for leaks of any kind. If all is good, then reconnect the battery terminals and start the engine.
- 4. Once your engine is running, perform another inspection for leaks of any kind. \*Note: it is normal for newly installed turbochargers to smoke during the first few minutes after start-up.
- 5. When the engine is fully warmed up, adjust the idle to factory specifications as described in the factory service manual.

**IMPORTANT:** Now that you have completed the installation process, you must tune your fuel injection system to match your new upgrades. Operating your modified vehicle without any additional tuning will most likely lead to catastrophic engine failure. \*Note: different engine/exhaust system combinations will cause the base boost pressure of this turbocharger system to vary. It is normal for vehicles with modified engines and free-flow exhaust systems to experience higher peak boost pressure levels than those produced by stock engines mated to catalyticback exhaust systems. Generally, base boost pressure should be between 9psi and 11psi. Test to make sure this is the case when you tune your vehicle. If you, at any time, hear the engine detonating, or see that the boost pressure is beyond 11psi without a boost controller, immediately back off of the throttle. Check all of your vacuum line connections for your turbocharger and wastegate assemblies, including the ones located beside and underneath the intake manifold. If your particular exhaust system is restrictive, you may require the use of a stiffer wastegate spring. Please contact XS Engineering, Inc. and ask about our wastegate spring exchange program.