



Subaru Stock Location EFR Installation

Subaru's EJ-series Boxer engine is a legendary powerplant with proven AWD drivetrain - a great foundation with significant room for increased performance through turbo upgrades. Full-Race began working with EJ20/25 engines in 2005 and constantly improved our products since. Today, our legendary EFR turbo kits and manifolds surpass the industry standard for high-end exhaust manifold design and fabrication - earning our reputation as the trusted source for top shelf Subaru turbo upgrades. We are proud to say our engineering, welding and fabrication quality are second to none! Full-Race's stock location EFR kits are 100% hand made in the USA and proven among Industry veterans like Jager Racing, Yimisport, AWD Tuning, COBB, CamTuning and daily driven grassroots enthusiasts around the world.



We combined this experience and track record with BorgWarner's EFR Turbochargers and applied it to the stock location Subaru configuration. This is a simple installation compared to rotated twinscroll. Using B1-frame EFR turbos allows for tangible power gains without compromising stock spool. This torquey fun-to-drive turbo response defines our vision of modern performance.



Subaru Stock Location EFR Turbo Kit Installation

The point of this article is provide anyone with knowledge of turbocharged engines to properly install the Full-Race Subaru Stock Location EFR turbo kit. While there are many ways to install a larger turbo, this article presents a few different options and "best-practices" tips specific to this engine and chassis combination. If this article helps you, please share it with others!

Installing a turbo kit requires a basic understanding of cars and turbochargers, a safe working environment and proper tools. Before beginning any work, we recommend you review the factory service manual and verify you have everything needed (oil, filter, coolant, wrenches, teflone tape etc). A turbo kit install is not a good idea to rush into blind - prepare mentally by spending some time to learn about your turbo and read the [BorgWarner EFR training manual](#). Get a good selection of tools and equipment to tackle the job. Experience with previous turbo vehicles helps but is not mandatory. If you're a 'noob' and scared of messing something up, don't stress - Take it slow and do some research, everyone starts where you are. For basics try reading: [Maximum Boost by Corky Bell](#) and [Street Turbocharging by Mark Warner](#).

Getting Started: Additional items needed for an upgraded turbo install are: 3" exhaust upgraded intake tube, tuning/fuel system and spark plugs. Upgraded Spark plugs are important for any high performance turbocharged engine. We use NGK Iridium BKR8EIX, gapped to 0.022-0.024". We recommend to upgrade [the exhaust manifold](#) - but it's not mandatory.



Tools required are about the same as doing a clutch install (plus a few extras). A good selection of metric combination wrenches, 3/8" and 1/2" ratchets with deep and shallow sockets with swivels/extensions, etc. In addition, and equally important - high-temp anti-seize must be carefully applied to all stainless steel threads and clamping surfaces such as: Exhaust manifold and housing bolts/studs/nuts, vband surfaces/nuts, wastegate actuator lock nuts and bracket screws, etc. **Always apply anti-seize paste to all threads and vband surfaces on the hot side of your turbo system.**

Step 1: Prep the EFR Turbo for Installation –

Before taking the car apart, start on the Bench. Prepping the EFR turbo for installation ahead of time saves hours on the install process. Aftermarket turbos require you to "clock" the center section bearing housing and orient the fittings. This literally means loosening the turbo to orient the bearing housing. In the case of the EFR we have a wastegate, BOV, coolant/oil feed and drain fittings and boost control all integrated into the turbo. This reduces the extra parts needed for the install and means we must clock into one specific, precise position - before attaching the turbocharger to the manifold. Take your time with this, it will set the stage for everything else to come.

Step 1a: Internal Wastegate Actuator Bracket

First, the internal wastegate must be clocked. **Note: the wastegate bracket location is next to upper coolant plug. Full-Race recommends the stiff borgwarner actuator for pumpgas applications and Turbosmart actuator for higher boost applications.**



Step 1b: Coolant Lines: Take note that the bottom port is to be used as the "coolant feed" and the opposite top port is to be used as the "coolant return" back to the engine. Coolant flows in on the bottom and coolant out on the opposite side's top port.

The bearing housing castings are water-cooled, and four M14x1.5 ports are provided. Two plugs are also provided so that the ports not being used can be capped off. It does not matter which side of the bearing housing gets the inlet flow and which side gets the outlet flow, but the flow must be diagonal across the housing. Also, the inlet port needs to be on the bottom and the outlet port needs to be on the top. This is to encourage evacuation of air bubbles as well as to encourage auto-siphoning (flow movement through natural convection) during the shut down's heat soak.

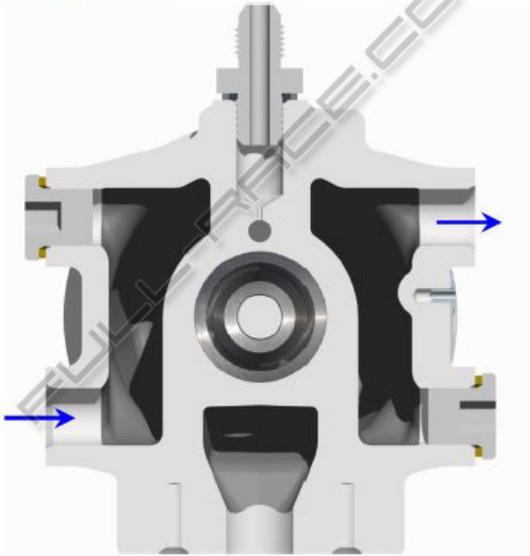


Figure 34: Cross-Flow (Bottom to Top and Side to Side) Nature of BH Water Cooling Plumbing

The reason for this coolant routing is that after the engine is shut off, we still want coolant circulating through the turbo! Heat rises, so thermal energy will keep coolant circulating despite the water pump not spinning. Note how we have them oriented, and ensure yours is done the same way. Use the supplied aluminum -6AN fittings and crush washers. Make sure to use high temp anti-seize on all exhaust side turbo hardware. The billet banjo fitting will feel like only 3 threads can get started, make certain to use Teflon tape as thread lubricant/sealant and tighten!

Assemble Coolant Feed fittings. Note IWG bracket and coolant plug position:



Assemble Coolant Return fittings. (EDIT: missing photo of coolant return installed)



***OR If using an 08+ Subaru you can reuse OEM turbo's coolant return hardline:**



Step 1c: Oil Feed and Return Lines

The -4AN Oil Feed fitting comes pre-installed. Loosely install the feed line.

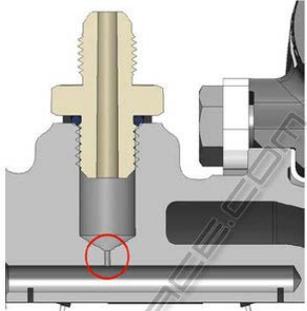


Figure 29: Oil Restrictor Integrated Into Bearing Housing



Figure 30: -4AN Oil Inlet Fitting (Supplied)



Next, install the oil drain fitting. 2 bolt drain flange/gasket is optional. Use Teflon tape on the fitting and be careful not to over-tighten or install it too deep! There is no pressure in the oil drain line so it will not leak. This is the only connection on the engine that is better to under-tighten than over-tighten! The reason for this is over-tightening during install without the 2 bolt flange may cause the fitting to be inserted too deep in the housing and will not allow oil to drain out of the turbo easily.



Step 1d: Install Full-Race BOV cover, upgraded spring and optional blockoff

Change the BOV cover from the borgwarner plastic to the Full-Race aluminum unit and upgrade to the stiffer spring. If using a TMIC you will also want to remove the OEM bov and replace it with the Full-Race blockoff plate



Step 1e: Tighten fittings and IWG actuator

Once all fittings are installed and oriented, double check crush washers and fitting tightness. Now it's time to start tightening down the turbo components and ensure that each hose and fitting are in the correct location. Conservatively set the IWG actuator to ~3-4mm preload initially - this is easy to increase during tuning. The threaded rod is a 6mmx1.0mm thread pitch. This means that each turn of the nut = 1mm preload. We recommend to use a sharpie marker and note the rear nut.



Figure 83: Holding Valve Closed with Nuts Loosened

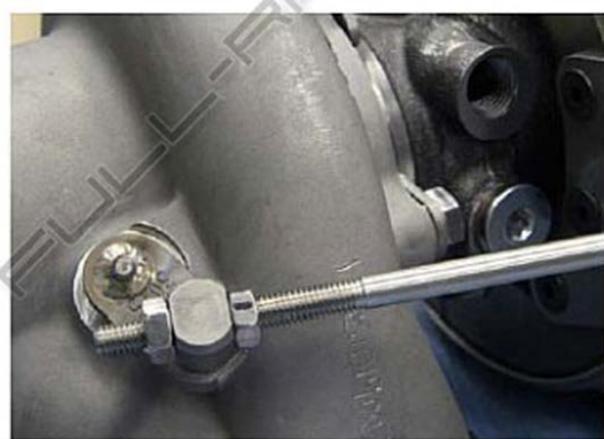


Figure 84: Line Drawn On Nut to More Easily Count Turns (2mm Preload Added)

Step 2: Remove stock turbo and up pipe. Prep Engine Bay

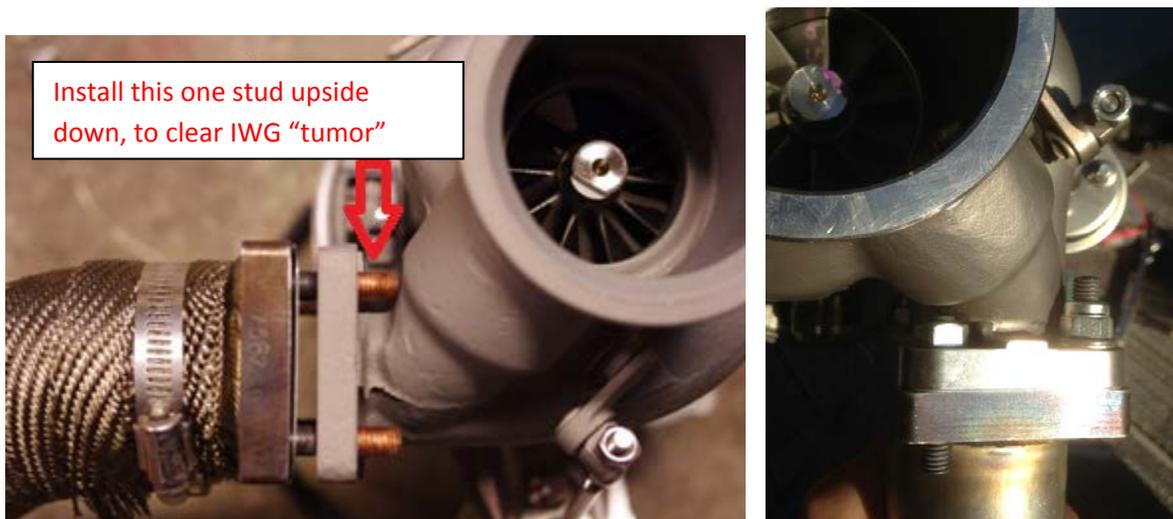
Now that the turbo is completely prepped and ready for installation we can start working on the car. Before removing anything, always disconnect the battery as a safety precaution. Get the vehicle in a safe place where you can access the downpipe, exhaust and turbocharger. A lift is highly recommended but Jack stands are a must if you do not have access to a lift. Get the engine bay cleaned and prepped for the install. Start by disconnecting the intake tube, downpipe, charge pipe, intercooler, oil lines, water lines, vacuum lines, turbo, etc. This car has a lot of parts in a small area, so removing the downpipe can be difficult. If this is a high mileage car with some rust - use thread penetrator like 'PB Blaster' before you decide to tackle the downpipe nuts.

Step 3: Install Full-Race up-pipe and manifold to engine

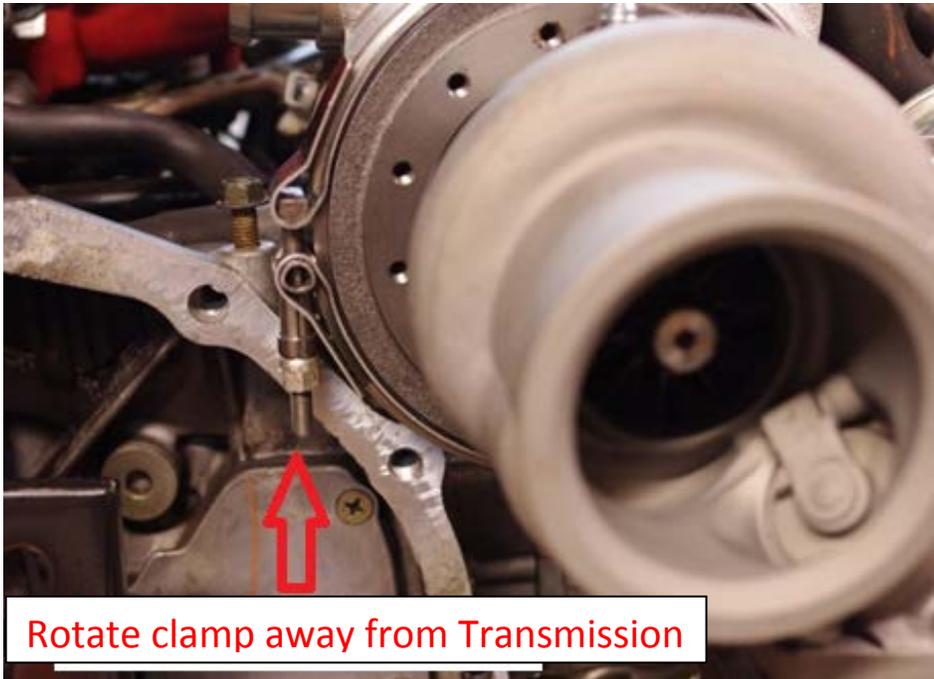
If manifold will be upgraded, install it now. Otherwise attach Up-Pipe to OEM lower manifold. Make certain gaskets are in place and **USE ANTI SEIZE** before tightening nuts.



Keep in mind the special high temp lock-washers included should remain as pairs and will be used on (3) of (4) bolts on the turbine housing. Do not separate or lose these, they keep tension on the turbo hardware and make sure the gasket stays leak free - never allowing vibrations or heat cycling to loosen. Also make certain the stud in the rear corner (by the wastegate tumor) is inserted upside down:



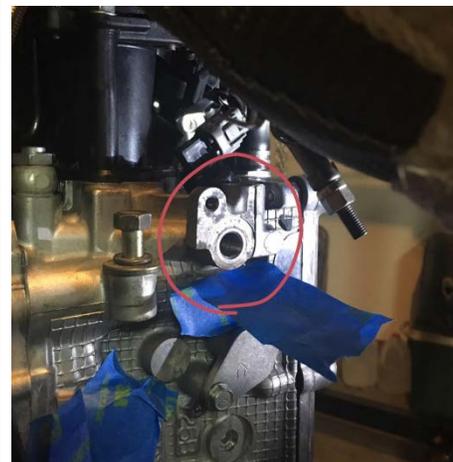
Step 4: Orient compressor vband. Position Turbo on Up-pipe



Step 5a: Install oil feed, and coolant feed fittings on block.



Install billet oil feed adaptor on OEM turbo fitting. This will allow the braided stainless -4AN line to thread on.



Note: If you have deleted the OEM tgv lines, you may replace this OEM feed-line / fitting with an M12->-4AN fitting, same as installed on the top of the EFR turbo. This M12 oil feed hole is shown in the red circle above right.

Step 5b: Connect and Fully Install Oil Drain and Coolant lines



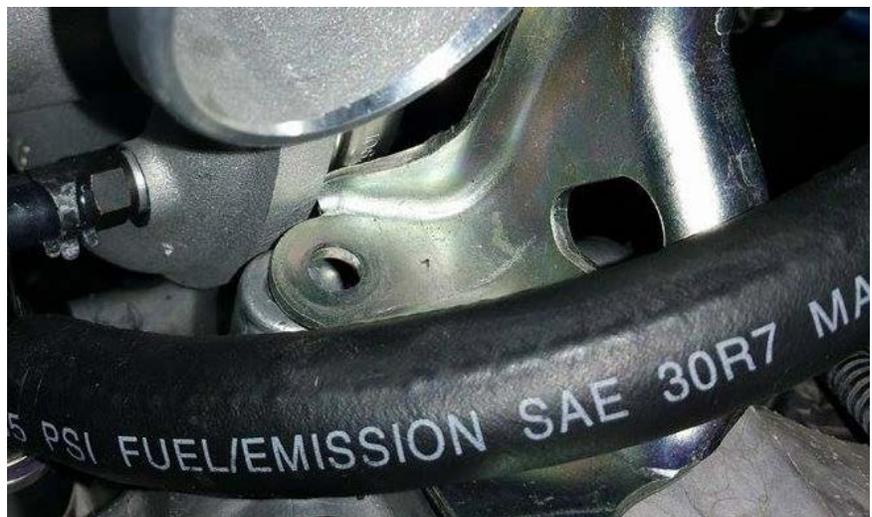
Step 6: Boost Control Solenoid Wiring

Two options here – use your existing boost control solenoid –OR- connect the supplied Boost Control solenoid pigtail to OEM wiring. This is VERY simple to do, remove the electrical tape, re-route the connector and plug into the BorgWarner solenoid. The wires are not polarity specific!



Step 7a: Intercooler and Charge Piping

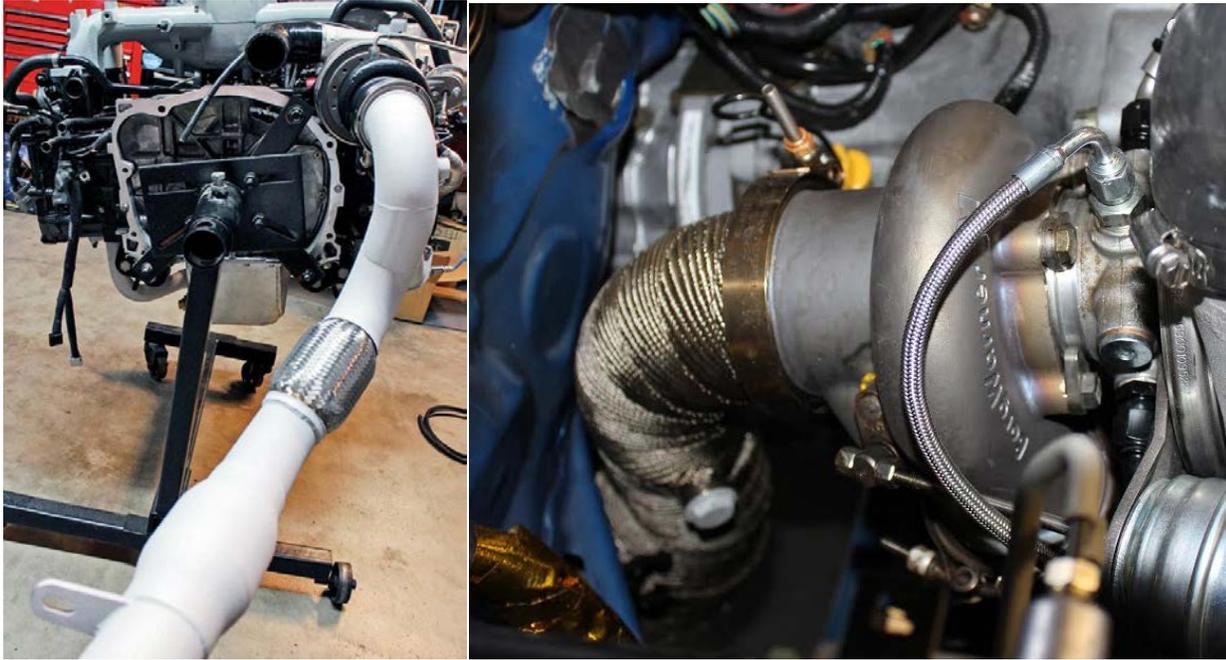
Depending on your IC configuration, connect piping. If TMIC is used the mounting bracket may need a slight “trimming”. Look over all couplers/clamps/pipes for clearance and proper orientation ensure that none of the charge pipes, couplers or t-bolt clamps are rubbing on anything. We suggest performing a boost leak test at this time to verify the install.



TMIC bracket requiring trimming:

Step 9: Connect 3" Downpipe/ Exhaust and Intake

The downpipe connects to the turbo using the 3" vband, this is the easiest part of the install. Make sure the vband's 10mm nut is easy to access from above AND that it will not interfere with the internal wastegate's actuator at full open position. We suggest using anti-seize on the inside of the vband clamp and on the threads for the nut as well as the O2 sensor bung. Install the o2 sensor and plug in. Connect mounting tab on transmission mount.



Step10: Connect Intake tube



Step 11: Finish Turbo Install. Prepare for tune!

The turbo kit should now be fully installed. Be sure to go over all hardware and fittings check for anything overlooked or still loose. Fill the engine with fresh oil, a new oil filter and fill the coolant (via the tube above the cylinder head). At this point, we recommend to tackle the fuel system, spark plugs and get ready for tuning. Unplug the coilpacks, and disconnect the oil feed from the motor. Disconnecting the fuel injectors is a good idea now. Have a friend crank the motor until oil pressure builds and oil blasts out of the oil feed line. Now, reinstall the feed line on the turbo and crank the motor AGAIN. Once there is oil pressure inside the turbo, check all connections one more time and get ready to start the engine. Plug the coilpacks in. Proceed to start the engine, checking for leaks. Let the engine run at idle speed for 3-4 minutes before driving.

BorgWarner EFR Turbocharger Factory Installation Guidelines

1. General

- A. When installing a replacement turbocharger, be certain there is no foreign material in the air cleaner and the ducting to the compressor inlet or in the exhaust manifold. Even small or soft objects will cause extensive damage to the turbocharger wheels.
- B. Take care to avoid getting dirt or debris into the turbocharger openings
- C. New and replacement turbochargers may have bolts deliberately left loose to facilitate installation.

1. Realignment of End Housings

- A. Loosen the compressor and turbine housing bolts and/or V-band nut the minimum required to permit the housings to rotate on the center housing. Excessive loosening of the housings will allow contact and possible wheel damage. Bolts should not have to be loosened more than 1 ½ turns.
- B. Temporarily secure turbocharger to the engine exhaust manifold outlet flange with two bolts.
- C. Rotate the center housing so that the oil inlet and outlet pads will mate with the engine lines. The oil outlet must be at the bottom with the center line of the hole not more than 35 degrees from vertical. Snugly tighten at least two bolts or the V-band as applicable, to lock the housing in place.
- D. Remove the turbocharger from engine and tighten all bolts and/or V-band nuts. Tighten both alternately from side to side to prevent cocking of the housing. Turn V-Band nuts slowly as the torque setting is approached, to allow for the band to fully seat.

2. Installation and Pre-Oiling of Turbochargers

- A. Remove old gasket from exhaust manifold mounting flange, inspect flange for erosion and flatness and install a new gasket if used.
- B. Inspect oil drain and supply lines for kinking, clogging, restrictions and other signs of deterioration.
- C. Install turbocharger on engine using all new gaskets and "O" ring, but do not connect the compressor inlet and oil supply line. Tighten the nuts or bolts attaching the turbocharger to the exhaust manifold. Using a high temperature lubricant on these threads is recommended.
- D. Fill the oil inlet hole with clean engine oil and spin the compressor wheel several times to coat the bearings with oil. Refill the oil inlet hole and connect the oil supply line.
- E. If the compressor wheel cannot be freely spun by hand or if there is any indication of rubbing or scraping, determine the reason before starting the engine. One cause of wheel rubbing is a cocked compressor or turbine housing. Connect the pipe or hose from the outlet of the air filter to the compressor inlet.
- F. Check lubricant level in engine crankcase.
- G. Prime the oil filter.

3. Start Engine

- A. Before attempting to start the engine, crank the engine with the fuel shut off for 10 to 15 seconds or until the instruments show an oil pressure buildup.
- B. Start the engine and allow it to run at idle speed for 3 to 4 minutes before accelerating.
- C. Check for oil leaks.