AVO420 Ball-bearing Turbocharger

for the Subaru WRX and STI

PN#WRX-1300-000

AVO's mid-range dual ball-bearing turbocharger for the Subaru Impreza WRX and WRX STI is here! Based upon our famous Edge Series design and with a larger CHRA center matched to the large AVO 4-5 exhaust housing, this turbocharger will put down some serious numbers. As this is a fairly capable turbo it is highly suggested to upgrade to a hi-flow fuel pump and fuel injectors. And of course, the more air it can pump, the better it works, so seriously plan for intake and exhaust upgrades as well. While this turbo can operate with a high-flow TMIC, a FMIC will become necessary past 400hp.

All of our ball-bearing turbochargers are water-cooled and comes with the proper oil and water lines. Our turbochargers have been designed to perform in the harshest conditions possible, and have been tested in them as well. AVO products are not designed to be as reliable as OEM - they are designed to be much better than OEM. High nickel content housings ensure our turbos will go the distance.
Another key performance points is the Garrett® compressor and turbine wheels, which are lightweight with knife-like edges for unmatched spooling, yet built strong for reliability. An AVO ball-bearing turbocharger is likely to outlast your engine.

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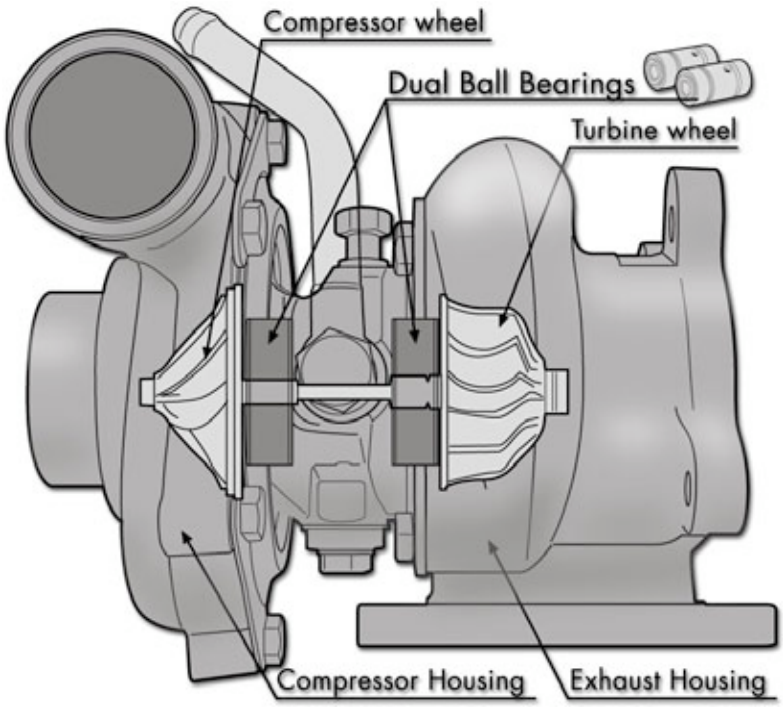
True Ball-Bearing Turbochargers
Thanks to single-cartridge, dual ball-bearing technology, Garrett® turbochargers generate far less frictional drag and are 10 times more durable than traditional journal-bearing turbochargers. New, efficient turbine stages deliver more power to your engine and allow ball bearing turbochargers to spool up faster than ever and have proven to be far more durable than journal bearing turbochargers.

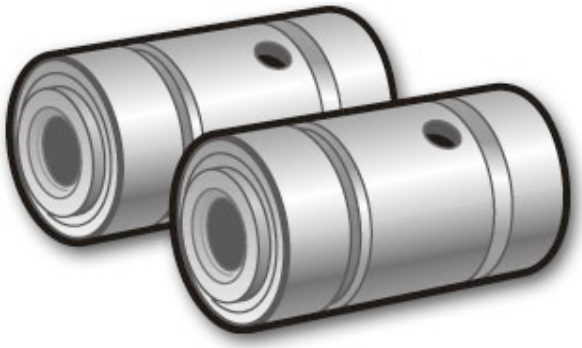
Journal Bearings vs. Ball Bearings
For a long time, journal bearings have been the standard technology used within a turbocharger, dating from when turbochargers were mainly used in diesel trucks. In the last few decades, turbochargers are being used with increasing frequency within passenger cars, which operate over a longer rpm range and use smaller petrol motors. To address the needs of the modern automobile, ball-bearing cartridges were designed to improve turbocharger response. Expensive at first, it is now an affordable technology advancement that provides significant performance improvements to the turbocharger.



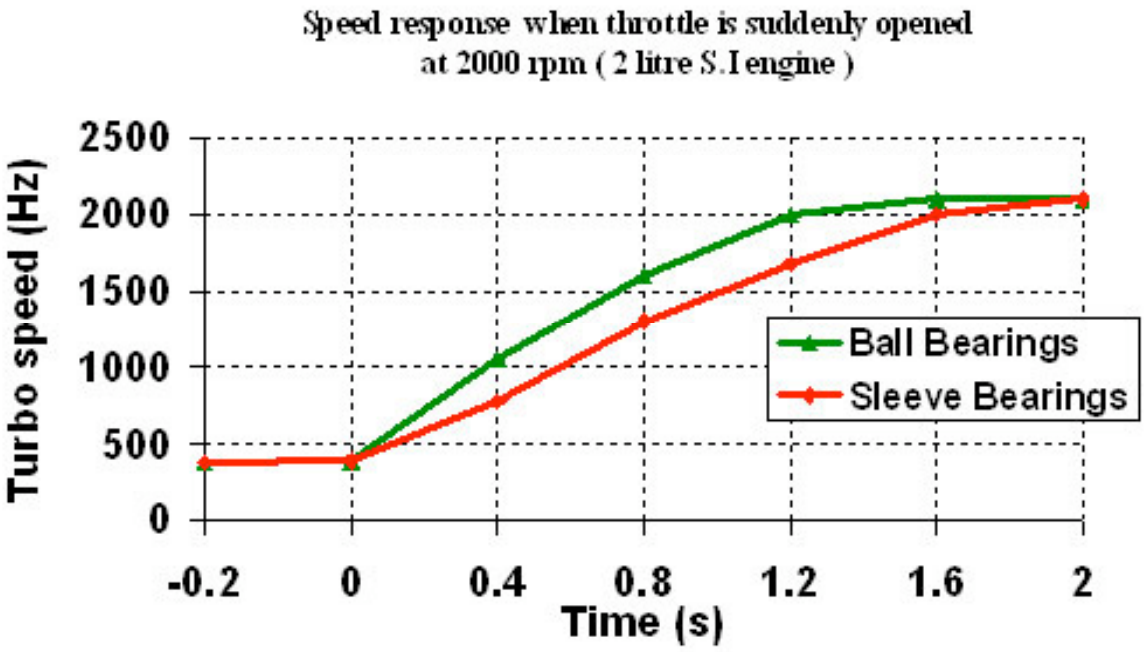
The ball bearing cartridge design is a single sleeve system that contains a set of angular contact ball bearings on either end, whereas the traditional bearing system contains a set of journal bearings and a thrust bearing.

Journal Bearing

Ball Bearing



Turbo Response
When driving a vehicle with the cartridge ball bearing turbocharger, you will find exceptionally crisp and strong throttle response. Ball bearing turbochargers spool up 15% faster than traditional journal bearings. This produces an improved response that can be converted to quicker 0-60 mph speed. And many AVO turbocharger users agree, with some feeling that it feels like they are driving a big, normally aspirated engine thanks to the incredible increase in response and the linear delivery of power.

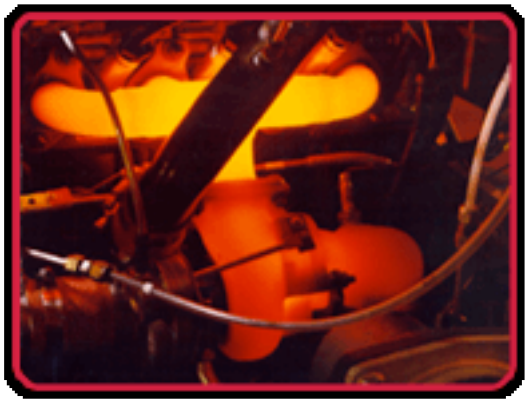


Reduced Oil Flow
The ball bearing design reduces the required amount of oil required to provide adequate lubrication. This lower oil volume reduces the chance for seal leakage. Also, the ball bearing is more tolerant of marginal lube conditions, and diminishes the possibility of turbocharger failure on engine shut down.

Improved Rotor Dynamics and Durability
Ball-bearing cartridges offer much better damping and control over shaft motion, allowing enhanced reliability for both everyday and extreme driving conditions. Too much shaft motion can lead to an early failure of the turbocharger, and is a leading cause of early failure with journal bearing turbochargers. In addition, the opposed angular contact bearing cartridge eliminates the need for the thrust bearing - commonly a weak link in the turbo bearing system.

Water Cooling

Following a hot shutdown of a turbocharger, heat soak begins. This means that the heat radiating off the hot engine head, exhaust manifold, and turbine housing finds it way to the center housing of the turbo, raising its temperature. Extreme temperatures in the center housing can result in oil coking, another cause of turbocharger failure.



To minimize the effects of heat soak-back, AVO only uses water-cooled turbo center housings. These use coolant from the engine to act as a heat sink after engine shutdown, preventing the oil from coking. The water lines utilize a thermal siphon effect to reduce the peak heat soak-back temperatures after you turn the car off. Please take care with the layout of the pipes, which should minimize peaks and troughs with the (cool) water inlet on the low side.

Wastegate & Turbo Housings

The AVO420 turbo uses an extra-large internal wastegate design that is built into the turbine housing, which consists of a “flapper” valve, crank arm, rod end, and pneumatic actuator. The AVO turbine housing is designed for maximum flow with an internally wastegated housing, as we run the largest wastegate swing valve possible to reduce chances of boost creep in high horse power engines. The quality of the AVO turbine housing is far above the rest with thousands of hours invested into R&D to insure our turbo housing performance. We only use the highest quality, high-temperature casting, which are machined on a 5-axis CNC machine to insure we maintain the precise tolerances necessary for maximum performance and reliability.

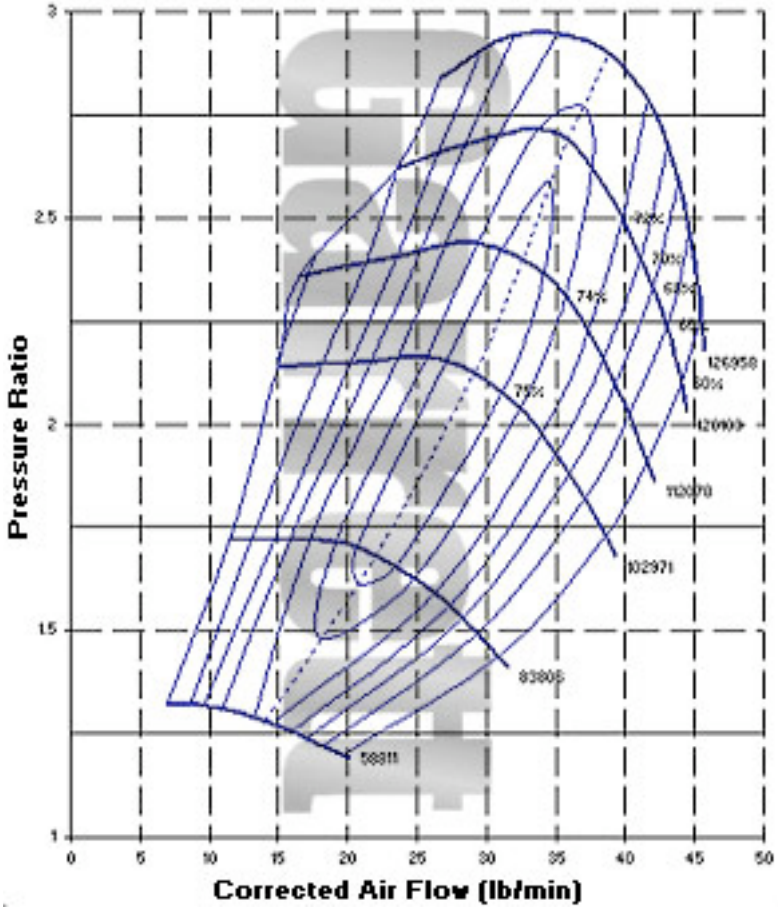
Turbine A/R
What is A/R? A/R is Air/Ratio, the internal area size of a turbocharger housing or compressor.

Turbine performance is greatly affected by the A/R of the housing, as it is used to adjust the flow capacity of the turbine. Using a smaller A/R will increase the exhaust gas velocity into the turbine wheel. This provides increased turbine power at lower engine speeds, resulting in a quicker boost rise. However, a small A/R also causes the flow to enter the wheel more tangentially, which reduces the ultimate flow capacity of the turbine wheel. This will tend to increase exhaust backpressure and hence reduce the engine's ability to "breathe" effectively at high RPM, adversely affecting peak engine power.

Conversely, using a larger A/R will lower exhaust gas velocity, and delay boost rise. The flow in a larger A/R housing enters the wheel in a more radial fashion, increasing the wheel's effective flow capacity, resulting in lower backpressure and better power at higher engine speeds.

When deciding between A/R options, be realistic with the intended vehicle use and use the A/R to bias the performance toward the desired powerband characteristic. The AVO420 uses the AVO 4-5 exhaust housing, which is has been designed for optimum performance with the Impreza 2.5-liter turbocharged motors.

Turbo Compressor Map 420



Compressor Covers
AVO Compressor covers have been specially designed for maximum flow and response. In our quest for maximum performance and reliability, we only use the highest quality castings and finish off our covers with 5-axis CNC machining to maintain the precision necessary for a high performance

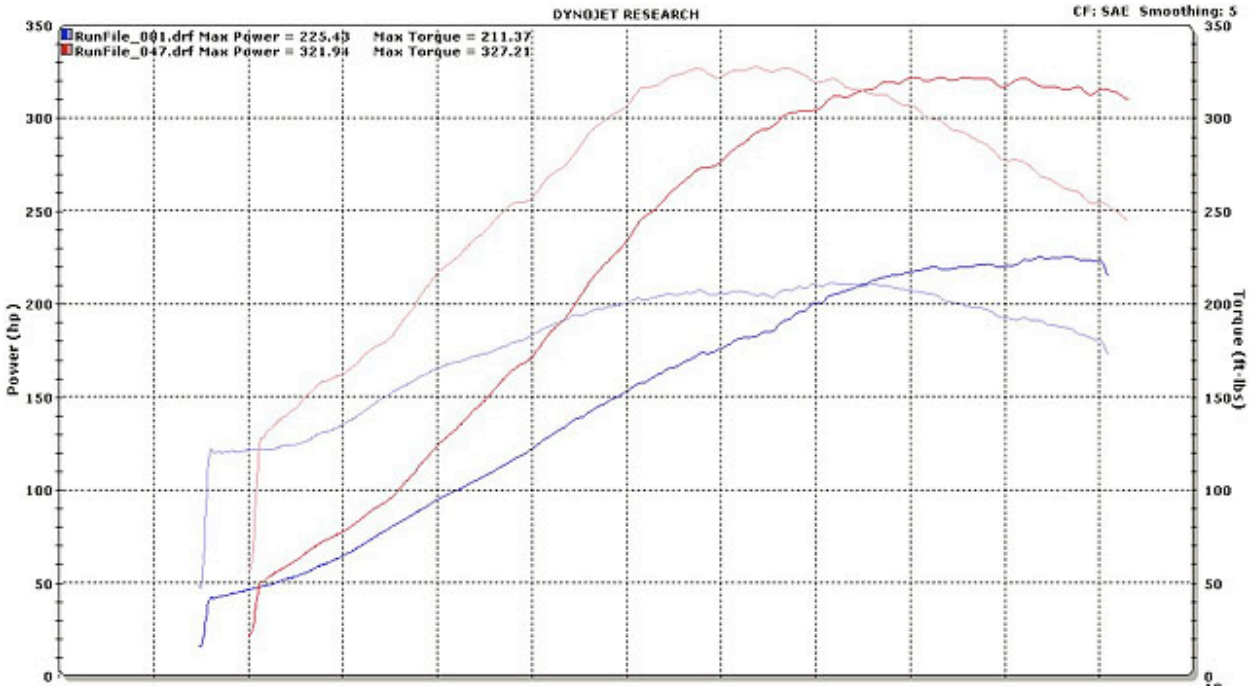
Compressor A/R
While compressor performance is not as sensitive to changes in A/R, they do still have some influence on performance. We have made sure to created the best size for optimal performance

Actuator
An AVO boost actuator gives the AVO turbo with a more controlled boost response while ensuring boost is maintained at a preset PSI level, resulting in increased torque and hp. The AVO actuator delivers constant boost all the way to redline and beyond. As an extremely safe, reliable and effective means of raising your boost level, the actuator comes with a minimum spring pressures of 15 psi and is adjustable for higher boost levels.

Fittings
AVO only uses the highest quality fittings with our ball-bearing turbochargers, as we are serious about reliability under the harshest of conditions.

Performance

This dyno chart is from the AVO420lgt on a Legacy GT fitted with the AVO v2 TMIC, an AVO TBE, intake, TGV deletes, fuel pump and injectors. And engine management via reflash, of course.
The blue graph is a stock Legacy GT that had been reflashed literally the day before, going from 196whp to 225whp. This helps give an idea of what it is like even in comparison to a stock VF40 that has had an ECU tune for more power.



Testing

AVO believes in testing their turbochargers under all possible conditions that our customers may use them in, from the street to the circuit. From the engine dyno to endurance racing, we don't leave anything to chance.