

turbo-zone

Insider Turbo knowledge for the garage professional



Turbocharging the
all-electric
record



SOLVING A WOBBLE
Advanced wastegates



SPINNING AROUND
The importance of oil



TURBO ACTUATORS
Each one is unique



The turbocharged all-electric record

This futuristic machine is Nissan's ZEOD hybrid, built to set a new record for the first all-electric lap of Le Mans at racing speeds. It succeeded – thanks to turbocharging.

Turbo power behind the headlines

Media focus was on ZEOD's all-electric 186mph max speed lap, powered by twin 110kW motors. Yet this was only possible because of ZEOD's tiny turbocharged internal combustion engine, which powered the other laps and charged the battery pack. And it's this petrol engine that's most relevant to today's new car designs.

As we reported in Turbozone 4, manufacturers are increasingly turning to small, turbocharged three cylinder petrol engines to meet ambitious economy and emissions targets. Nissan's ZEOD three cylinder engine is certainly small – at 500 x 400 x 200mm, it would be allowed as cabin baggage by most airlines. It's also very light: just 46kg including the Garrett turbo and exhaust system.

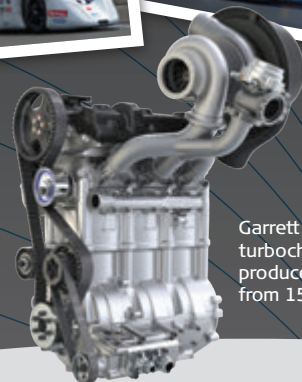
Small is beautiful

Lightweight, compact power unit packaging is the Holy Grail for car designers; smaller, lighter cars require less fuel and produce lower emissions. Yet these small engines only achieve their impressive efficiency because turbocharging produces significantly more power than a normally aspirated engine of equivalent size.

While small turbocharged petrol engines may not create the media buzz of electric racing motors, they're already accounting for a major percentage of new car sales. While you're unlikely to see a ZEOD in your workshop, you'll be seeing many more models powered by engines similar to its small but potent petrol unit.



ZEOD's petrol engine: small enough for cabin baggage.



Garrett turbocharging produces 400 bhp from 1500cc.

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TURBOCHARGERS

BTN Turbo is the only UK supplier of all major turbocharger brands.

What goes around...

...only keeps spinning around because it's protected by oil. At BTN Turbo, we constantly emphasise that the correct quantity and grade of quality engine oil is essential for turbo protection. And with today's more sophisticated turbos, oil's role is even more vital. Let's stop for a moment and consider why.

Traditional turbos use hydrodynamic bearings for the turbine and compressor wheels and shaft. Hydrodynamic means the oil not only lubricates, but also damps the radial and axial motion controlled by the bearing journal and thrust bearing. This puts the oil under extremely high pressure.

Modern turbos combine journal and thrust bearings in a single steel or ceramic ball bearing cartridge to minimise friction losses. Their efficiency allows turbos to spin even faster (more than 4,000 revs per second), generating even higher operating temperatures.



So let's review what the oil in a turbo has to do:

- damp the radial and axial forces and vibration from the rotating parts
- minimise friction losses to maximise power and economy
- cope with exceptionally high pressures and temperatures
- lubricate bearings spinning up to 60 times faster than the engine.

When you change a turbo and at every service, use high quality oil, to the manufacturer's specified grade and quantity. Otherwise those hard working bearings may not keep the turbo spinning around much longer.

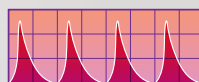
How Garrett stops the wastegate wobble

There have been wastegated turbochargers for decades, but with the increasing move from four to three cylinder engines, a problem has emerged.

Three cylinder engines produce a wastegate 'wobble' - an exhaust pulse that makes the wastegate valve difficult to control. So Garrett has produced an entirely new valve, with a toroidal profile that sits in a symmetrical, conical seat. It seals more effectively when closed and reduces pulsation and vibration as it opens.

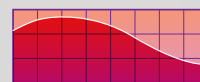
Garrett's unique design ensures the wastegate turbo operates efficiently, quietly and reliably with a three cylinder engine, allowing motorists to benefit from improved performance and economy.

Conventional flat valve wastegate



Cylinder exhaust pulses cause conventional wastegate valves to fluctuate preventing precise control.

Toroidal valve wastegate for 3 cylinder engines



The toroidal wastegate valve and conical seat reduces pulsation to allow linear, progressive control.

Why Garrett Original Reman is the

the perfect fit

Among the 18,000+ turbos we stock at BTN, there's a wide selection of Garrett Original Reman units, available through our OMX Exchange programme and indistinguishable from new.

COMPLETE STRIP DOWN

When Garrett rebuilds a turbo, the unit is stripped, cleaned and minutely inspected. Every critical part is replaced with new original Garrett components, and tolerances checked within microns. Finally, the turbo is recalibrated so it matches its original performance in every parameter.

WATCH THE VIDEO

You can see the whole process for yourself in Garrett's video at <https://garrett.honeywell.com/products/reman/>

GENUINELY AS GOOD AS NEW

When you order a Garrett Original Reman turbo through BTN, it comes with the same benefits as a brand new unit: our timesaving FitKit, and a two year warranty. Plus the reassurance that by fitting a turbo that's literally as good as new, you'll only have to fit it once.

THE REMAN PROCESS

- > *Critical components replaced*
- > *Turbo rebalanced*
- > *Turbo retested*
- > *Turbo recalibrated*
- > *New turbo warranty applied*



Garrett[®]
by Honeywell



▶ www.btnturbo.com

Spot the difference.



Difficult isn't it? Whichever turbo you choose from BTN it's always 100% Original Equipment (OE). And all our turbos come with a 2 year warranty, free FitKit with an oil-filled pre-priming injector for safer installation, and fitting instructions*.

So what's the difference? On the left is a brand new OE turbo exactly as originally fitted, with all the BTN extras and at a very competitive price.

On the right is an Original Manufacturer's Remanufactured turbo, available exclusively through our OMX exchange programme – expertly rebuilt and calibrated to the original specification and totally compatible with the vehicle's ECU.

A Manufacturer's Remanufactured turbo can save you up to 40% so it's especially cost-effective for older vehicles. There's a surcharge, refunded on return of the old unit.

Whichever you choose, with BTN Turbo you'll have the benefit of 40 years' turbo experience, our online diagnostic support and helpline.

We keep over 18,000 brand new and Original Manufacturer's Remanufactured turbos in stock, to help your factor supply the turbo you need with next day delivery. All you need to do is decide: 100% OE or 100% OE.

* Oil feed pipes are available for recommended applications.

Garrett[®] by Honeywell **BorgWarner** **MITSUBISHI** TURBOCHARGERS

BTN Turbo is the only UK supplier of all major turbocharger brands. Diagnostic information available at www.btnturbo.com or on the technical helpline 01895 466663.

What makes each variable turbo actuator unique?

The answer is, the turbo it's fitted to. The electronic actuator minutely controls the moving turbo vanes, to achieve optimum power, torque, emissions and economy. Calibrating the actuator is the last stage of turbo production.

UNIQUE SETTINGS

Garrett individually calibrates each actuator to its particular VNT™ variable turbo, using a computer controlled flow bench. As the settings are unique, actuators can't be reliably swapped between turbos. The turbo might work, but there's no guarantee it will perform to the OEM spec.

ORIGINAL PERFORMANCE

That's why VNT remanufacture is best left to the original manufacturer. During production, Garrett records the actuator's calibration data against the turbo's serial number. When they remanufacture that turbo, they reset the actuator to the original settings, to deliver the exact original performance.

BTN Turbo supplies a wide range of Original Manufacturer's Remanufactured turbos from Garrett, all rebuilt by them to 100% OE spec, and saving up to 40% against a brand new unit.



Was a **REMAP** to blame?



Oil problems and foreign object damage are the cause of 95% of all turbocharger failures. But excessive temperature can also kill turbos.

Turbos can withstand the exhaust gas temperatures generated during normal operation. But if exhaust gas gets too hot it can ruin the housing, turbine or wastegate.

CHIPPED OR COOKED?

Excessive exhaust temperatures can be due to poor servicing, cooling faults or insufficient, incorrect oil. They can also be caused by

remapping the engine. 'Chipping' the ECU to increase power or torque can push the engine and the turbo beyond their design limits.

It's vital you diagnose the reason for failure before fitting a new turbo; our diagnostic section on www.btnturbo.com provides valuable help. But if that hot hatch owner complains about loss of power, a smoky exhaust or a cracked turbo housing, asking them if the engine's been remapped could save you a lot of time!



The turbocharger people

BTN Turbo is the world's largest independent turbo supplier.

Over 18,000 OE turbos in stock, new first fit or remanufactured by the original manufacturer. All with 2 year warranty.



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Contact your local factor for a turbo from BTN or call us to locate your nearest stockist.

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