

# THE HOT TOPIC

**OUR MAN ON THE WEST COAST RUNS US THROUGH CURRENT EMISSIONS-TESTING PROCEDURES AND THE BEST WAY TO ENHANCE YOUR EMISSIONS-BOUND VEHICLE LEGALLY**

STORY AND PICS BY RICK MCDOWELL

**A** benchmark was set late last year when LS1Turbo achieved ADR79/01 tailpipe emissions compliance for their Gen TT VE system in association with the WA Performance Centre. With ADR 79/01 being a hot topic of conversation amongst Australia's forced-induction specialists, and with ADR 79/02 introduced in January this year, emissions can no longer be ignored.

While many of the big names on the forced-induction front here in Australia have blown budgets on achieving 79/01 approval for their kits, it is rare for a smaller player or even individual to do so.

Yet times are changing, and with increased environmental awareness as well as mounting pressure from the authorities towards modified vehicles, LS1Turbo has slapped its cards on the table and effectively said "Match that".

Passing ADR 79/01 wasn't simply a matter of shoving a probe up the exhaust pipe of the WA Performance Centre's VE after the LS1 Turbo Gen TT kit was fitted. All new vehicles sold in Australia during 2006 and 2007 must abide by this emissions standard.

Only a few laboratories in Australia are capable of testing to ADR 79/01 standards, and one such is the Orbital Corporation facilities in Perth. The OEMs own the other laboratories capable of performing ADR

79/01 emissions compliance and certification testing, and even the tester is tested.

According to Chris Beatty, Orbital's test area supervisor, "Orbital has been issued a test facility identification number by the Department of Transport and Regional Services, and we are audited in the way we do our tests, our calibration and control methods, maintenance schedules and so forth".

ADR 79/01 is directly equivalent to the Euro III emissions standards that came into effect in Europe in 2000. Similarly stringent standards were introduced in Japan the same year, while the US received its version in 2001.

It all shows just how far behind Australia really was in respect of vehicle emissions – must be something to do with our no-show on the Kyoto Protocol.

In layman's terms, the whole idea of ADR 79/01 is to reduce the amount of chemicals being spewed into the atmosphere not only by the vehicle's exhaust system, but through fuel evaporation and crankcase emissions as well.

If you're not into chemistry, then oxides of nitrogen, carbon monoxide, sulphur and hydrocarbons will mean very little. Although proven links with cancer, asthma, lung disease, brain disorders and more are fact.

At the time of test, ADR 79/01 was the pinnacle of emissions regulations for gasoline-powered vehicles in Australia.



Orbital's test area supervisor, Chris Beatty, sets everything up on the computer before starting the ADR 79/01 test procedure



Look closely and you will see the crosshairs. Chris has to keep the "Target" on a set course using the accelerator and gears. No deviation from the course is allowed

ADR 79/02 (equivalent to Euro IV) came into effect a few months back in January of this year.

This will see the emissions limits for gasoline passenger vehicles halved from their current levels. The ADR 79/01 emissions certification test for gasoline-powered passenger vehicles, which the LS1 turbo passed successfully, is made up of four 'Type' tests.

Of all four, it is the Type 1 test that simulates average tailpipe emissions after a cold start, which is of most interest.

The tailpipe emissions test is conducted during what is called a 'Drive Cycle'. Here, the vehicle is strapped onto an emissions-chassis dynamometer. This is usually an inertia-simulation dyno that is electronically configurable to simulate the inertia of the individual vehicle under test.

It applies the same load to the vehicle as it would be subjected to while driving along a city street. Orbital uses an MRW electrical inertia-simulation dyno from the UK, and though not a particularly common name in our world of dyno shootouts, it is an industry-standard device for emissions testing.

It uses a 48in single roller that is connected to a 200kW DC motor for load absorption and control. Before the vehicle is loaded onto the dyno, it must be filled with a special laboratory-standard test fuel that comes from Europe and costs \$10/L (and you thought \$1.50 was expensive!).

According to Chris, "Every fuel supplier has its own blend of additives that are added at the terminal to the fuel you buy at

the local servo. However, the ADRs dictate an additive-free fuel that is blended to tightly controlled specifications".

In theory, even if the car passes in this controlled environment, a batch of sketchy fuel could have you fail an EPA inspection later.

With the vehicle in place and a test operator in the driver's seat, a computer screen is then positioned in front of the windscreen. The operator must use the accelerator and gears to follow a cursor on the screen carefully, which moves along a defined path: the drive cycle.

Obviously, the roller speed, load on the dyno/engine, use of the throttle, cursor position etc are all linked, and there is very little deviation allowed from the prescribed course. Not surprisingly, this is a job for a skilled operator.

As Chris explained, "the computer logs any of the driver errors during the test, and if the driver error limit is exceeded, then the test is a fail".

Of course, what is really important is all the nasty stuff exiting the vehicle's exhaust system during the drive cycle.

"The exhaust emissions will vary in volume and concentration according to changes in engine and catalyst temperature, engine load and engine speed. So, in order to calculate the emissions produced during a period of vehicle driving, the test method must average this constantly changing flow.

"We achieve this by mixing the exhaust flow with suitably conditioned 'make up' air and draw this mixture



Using the gears and accelerator, the operator must follow a set course that the computer screen determines



All of the nasty stuff is stored in these bags in diluted form and the computer then calculates the parts per million



They even have their own built-in coffee percolator in the Orbital lab

through a critical flow venturi during the drive cycle test.

"At sonic velocity, the CFV will pass a constant volume of this mixture. So regardless of engine speed, we maintain a homogenous mixture of diluted exhaust, flowing at a constant rate to sample from during the test," Chris explains.

If you didn't manage an A grade in high school chemistry, you're probably a bit lost by now. However, in layman's terms, ambient air from the test cell is drawn in and mixed with the emissions from the vehicle being tested.

During each of the two test phases, a proportion of this diluted exhaust gas flow is drawn through a second sample venturi along with a sample of the test-cell ambient air. It is then collected and stored in two large plastic Tedlar bags for later analysis.

Two pairs of sample bags are used for the two-phase ADR 79/01 Type 1 test. This includes the cold start (Part 1 Urban Cycle) and the hot transient (Part 2 Extra-Urban Cycle), which run for 780 and 400 seconds respectively.

On completion of the test, the emissions the vehicle produces over the duration of the drive cycle are calculated. Subtracting the concentration of pollutants in the ambient samples from the concentrations measured in the bags achieves this (remember we diluted the exhaust gas flow with ambient air).

Using pollutant gas-density constants programmed into the Vehicle Emissions Test System (VETS) and the distance recorded from the rolls, the mass of regulated



Ambient air is drawn in from the test cell and mixed with the gases to form dilutions that are stored in the big bags

emissions the vehicle produces over the drive cycle can be calculated and reported in grams/kilometre.

Overall, emissions will become a hotter topic in the coming months. It's worth noting that the new ADR 79/02 requirements introduced in January 2008 for brand-new vehicles are considerably tighter than with ADR 79/01.

A brand-new 2008-model vehicle fitted with an aftermarket forced-induction system would need to produce half of the tailpipe emissions of a 2006/2007 model car fitted with an aftermarket forced-induction system. Interesting times ahead, indeed.

**LEGAL BANTER**

The subject of emissions, ADRs and the associated legality of aftermarket forced induction is a can of worms many would prefer not to open. Nonetheless, it can all be broken down and simplified to a certain degree.

Every brand-new car in Australia is sold as a fully legal product that has met and passed a massive range of ADR requirements. This includes everything from the wheels and tyres to position of lights and, of course, emissions.

As such, brand-new vehicles are said to be 'certified' to meet the requirements of the federal Department of Transport and Regional Services Vehicle Safety Standards scheme.

Once registered, the vehicle's 'in-service' compliance becomes a state or territory matter. The Roads and Traffic Authority (NSW), Department of Planning and Infrastructure (WA), RACV and RACQ are in control of the vehicle's licence.

Policing of the vehicle's continued compliance with both ADRs and local laws is where the worms begin to crawl out of the can. Hell, sometimes it feels like it's enough to hang a Christmas tree air freshener from your rear-view mirror to make a vehicle illegal in most states.

For the purposes of this feature, we will leave the debate about wheels, suspension, bodykits and the rest to concentrate on engine mods and emissions.

Briefly, any modification made to a stock vehicle puts it in breach of the ADRs. That's whether you remove the factory air box for an aftermarket pod filter with cold-air induction or go all the way with a complete engine rebuild and aftermarket forced-induction system.

The exception is where an engineer signs off the modifications and components used for the enhancement. They must prove to satisfy the requirements of the relevant ADRs that are the focus of the Vehicle Safety Standards Act. That last bit is about emissions, and this aspect brings into play ADR 79/01.

This new emissions standard for Australia was introduced during the 2006 model year, and as indicated in the main story, it is equivalent to the Euro III standard introduced throughout the EU way back in 2000.

It is understood that adding turbos or a supercharger to any post-2006 vehicle is really going to play havoc with ADR 79/01 compliance. Several major forced-induction players here in Australia have passed the ADR 79/01 test for their kits, but that's not quite the end of the story.

In general, an ADR 79/01-approved turbo or supercharger kit will be for a specific engine or car, and any deviation from the components used in the ADR 79/01 test will make the kit illegal.

Want to increase the boost or add a different pulley? Maybe that new high-flow exhaust system sounds tempting. If they were not the components used in gaining 79/01 approval, then forget it.

In addition, even if an ADR 79/01-approved kit is fitted to the vehicle, an engineer's certificate may still be required in most Australian states for the vehicle to be street legal.

While there might be blanket approval for Brand Y's supercharger kit on the VE, engineer's certificates are an individual requirement and cannot be done on a blanket system. Oh, and there's another certificate you might not be able to get without being legal.

At least one major Australian insurance firm is now asking for engineer's certificates before covering modified vehicles.

However, it's not all bad news. Australia's leading players on the forced-induction front are well aware of the situation and have systems in place to help the customer achieve complete legality for their modified vehicle.

In fact, there's little doubt that the marketplace is changing, which is partly in response to increased environmental awareness in society and partly from increasing bureaucratic pressure. Legal, green performance is the way of the future, and it is here already. **SC**



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More than just stuffing a sensor up the exhaust pipe, ADR 79/01 requires a sealed exhaust system, and the total waste product is thoroughly analysed



Guess who has been testing cars in the Orbital labs?



Only really brainy people who can speak big words work at Orbital

