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**EQUA Air Quality Index Technical FAQ**

*Q. What levels of emissions does each rating equate to?*

A. The ratings scale is based on the level of emissions of nitrogen oxides (NOx) in grams per kilometre – which is the official measure under European regulations. The EQUA Air Quality Index aligns the boundaries between ratings values as much as possible with recognisable points.

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| **Rating** | **Lower bound (g/km, exclusive)** | **Upper bound (g/km, exclusive)** | **External reference point** |
| A | 0.00 | 0.08 | Meets Euro 6 limit for diesels, and meets Euro 4 limit for petrols |
| B | 0.08 | 0.12 | Meets 1.5 Conformity Factor under Euro 6 Real Driving Emissions regulation |
| C | 0.12 | 0.18 | Meets Euro 5 limit for diesels (and similar to 2.1 Conformity Factor under Euro 6 Real Driving Emissions regulation) |
| D | 0.18 | 0.25 | Meets Euro 4 limit for diesels |
| E | 0.25 | 0.50 | Meets Euro 3 limit for diesels |
| F | 0.50 | 0.75 | No comparable Euro standard: roughly equal to 6-8 times Euro 6 limit |
| G | 0.75 | 1.00 | No comparable Euro standard: roughly equal to 8-12 times Euro 6 limit |
| H | 1.00 | None | No comparable Euro standard: roughly equal to 12+ times Euro 6 limit |

Using this scale, a diesel vehicle with an A EQUA Air Quality Index rating can be said to meet the Euro 6 regulatory level even in real-world driving.

*Q. What is wrong with the current official emissions test?*

A. The current type approval test, required before a car can go on sale, is conducted in a laboratory on the New European Driving Cycle (NEDC). This is a cycle of less than 20 minutes with low average speeds, low rates of acceleration, no gradients and therefore tests the performance of the vehicle with the engine under relatively low load.

Real-world driving typically puts higher loads on the engine, but this remains largely untested. In addition, the test protocol contains a number of leniencies that can be exploited and optimised to achieve low emissions performance on the official test.

From 2017, new regulations will be introduced to address the problems in both CO2 and NOx measurement, with the World Harmonised Light Duty Test Protocol (WLTP) for the former and Real Driving Emissions (RDE) for the latter.

*Q. What is Real Driving Emissions (RDE)?*

A. In order to tighten up the regulation of NOx emissions, the European Union will introduce an enhanced type approval certification test from September 2017. This will add to a controlled laboratory test an on-road test using Portable Emissions Measurement Systems (PEMS). Vehicles will be required to meet the regulated NOx limit (0.08 grams per kilometre for diesels) exactly in the laboratory but with a margin of error (called a Conformity Factor) in the on-road test. Initially this Conformity Factor will be set at 2.1, but falling to 1.5 from September 2019 and potentially further thereafter. So, from next year, vehicles will have to emit no more than 0.168 g/km of NOx in on-road operation (the regulated limit of 0.08 g/km multiplied by the 2.1 Conformity Factor).

*Q. Are all vehicles rated on the same scale?*

A. Yes. Whether vehicles are diesel or petrol/gasoline, or Euro 5 or 6 regulatory stage, they are rated on the same scale, shown above. This means that, for example, a petrol car can be compared directly to a diesel car for its NOx emissions.

*Q. How many vehicles do you test per year?*

A. Emissions Analytics tests between 200 and 400 vehicles each year in the European Union. It’s also active in the United States, testing a similar number of vehicles, although these are not included within this ratings programme currently.

*Q. Are PEMS suitable for NOx measurement?*

A. PEMS are used for the regulatory testing of nitrogen oxides in Europe for heavy duty vehicles, and are planned to be used similarly for passenger cars from 2017. The equipment is used more widely by the US Environmental Protection Agency for in-service surveillance testing.

The equipment used by Emissions Analytics meets the standards of UN-ECE R-49 and Commission Regulation (EU) No. 582/2011 in the European Union, and 40CFR part 1065 in the United States. Further details of the equipment used can be found at <http://www.sensors-inc.com/>. The repeatability quoted by the manufacturer for NOx is typically +/-2%. Emissions Analytics calibrates the equipment to known gas concentrations for each test, according to the equipment manufacturer’s recommendation.

*Q. What age are the vehicles you test?*

A. Vehicles are typically tested within a few months of first registration and have between 1000 and 5000 miles on the clock. This age of vehicle is used because it ensures that the vehicle has been “de-greened” for a period, but has not be exposed to the variables associated with longer-term operation, including service standards and vehicle care more generally.

*Q. Do you test used cars?*

A. Currently the EQUA Index programme focuses on testing cars when new, where the service history of the vehicle does not affect performance. Having tested for over five years there’s a back catalogue of ratings for vehicles, which are now exclusively available in the second-hand market, although they were tested when new.

*Q. How are factors such as driving style, changes in altitude, ambient temperature, ambient humidity and engine temperature taken into account?*

A. As many factors as possible are kept constant between tests, including the route, drivers and their driving style. The vehicles are fully warmed up when the test starts. Ambient conditions must fall within parameters that ensure testing is not conducted under extreme high or low temperatures, rain, snow, ice and high winds.

*Q. How is the weight added to the vehicle kept constant, as drivers and passengers can vary significantly in weight?*

A. The added weight to each vehicle is the same, approximately equal to being half-loaded for an average car. The weights of the driver, passenger, equipment and level of fuel in the tank are taken into account and then additional ballast is used to bring the total weight up to the benchmark level.

*Q. What fuel is used in the vehicles and can this affect the results?*

A. The fuel used is a standard grade petrol or diesel, conforming to EN590 and EN228 regulations respectively. The only variation from this is if the vehicle manufacturer requires the use of a premium grade. If a premium grade is only “recommended”, then the standard grade is used. The fuel is sourced from a single filling station, which remains the same over time. This enables the best balance of using the same fuel that customers can buy in the real world and consistency over time. With these controls in place, the remaining variability is not material to fuel economy.

*Q. To what pressures are tyres inflated?*

A. The manufacturer recommended tyre inflation pressures are used for each vehicle, checked before each test.

*Q. Do you test every variant of each model?*

A. We aim to test each model where the model year, engine size, fuel type, power, number of driven wheels, transmission or Euro regulatory stage are distinct. We consider vehicles materially similar where the difference is only in body style, number of doors or trim level. This is more restrictive than the “families” of vehicle defined under the type approval process.

*Q. Is there a validation programme that confirms that test cycle has been completed satisfactorily?*

A. Yes, there is a validation programme, which has been designed specifically by Emissions Analytics. This ensures that the cycle overall, and sub-sections of it, meets a number of validity tests, including average speed, acceleration, presence of Diesel Particulate Filter (DPF) regeneration, engine coolant temperature, ambient climatic conditions, and so on. This ensures that there is the greatest consistency possible between different tests of different vehicles on different days.

*Q. How are different driving styles factored into the results?*

A. The driving style across the test is kept constant by using a small team of drivers who are all trained to drive in the same way. This is verified for each individual test and a more detailed audit of driving styles is conducted annually. Within each test, different rates of acceleration are used at different points in order to assess the vehicle performance, but this approach is applied consistently between tests.

*Q. How are the repeatability and reproducibility of results assessed?*

A. Repeatability and reproducibility are assessed on a number of levels. First, within each test, repeated identical sub-segments must match each other within certain parameters. Second, a sub-sample of vehicles is retested under the same conditions to ensure consistency. Third, all results are compared to Emissions Analytics’ database to ensure a broader consistency with similar models and technology types. Fourth, a sub-sample of models is selected such that different instances of the same models are tested for inter-model consistency.