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## COMPARATIVE ANALYSIS OF NOX EMISSIONS OF TWO VEHICLES

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**Abstract:** The purpose of this work is to evaluate and compare the emissions of two vehicles, to determine the differences in environmental performance and identify the possible causes of the variations.

The current state of the art in the field of reducing vehicle emissions is marked by rapid evolution, mainly imposed by increasingly strict regulations, such as the Euro 6 and the upcoming Euro 7 standards. These regulations specifically aim to reduce emissions of carbon monoxide (CO), nitrogen oxides (NOx), unburned hydrocarbons (HC) and fine particles (PM). The materials used in the comparative study on the emissions of two vehicles are: the vehicles studied, the emission measurement equipment. The methods used are: vehicle preparation, test procedure, data collection and analysis.

The Volkswagen Passat E6 is superior in terms of emissions compared to the Volkswagen Golf E4. The Golf E4, on the other hand, could be a more economical option, but with a greater impact on the environment.

Automakers use a range of advanced technologies to meet pollution standards: -Exhaust gas after-treatment systems; -Exhaust gas recirculation (EGR): a system that recirculates part of the exhaust gases to reduce the combustion temperature in the engine, which reduces the formation of NOx; -Electronic control systems (ECU): these are the "brains" of the engine. The ECU constantly monitors and optimizes operating parameters, such as fuel injection and ignition timing, to ensure the most efficient combustion and minimize emissions.; -Hybridization and electrification: The shift to hybrid vehicles and, in particular, fully electric vehicles (EVs) is a major direction, as EVs have no direct tailpipe emissions.

For any driver, the operating condition of the car is important, and of all the testing and checking actions of a vehicle, the most important is the Periodic Technical Inspection, which we all know by the abbreviated name ITP.

### • Introduction

The Volkswagen Passat and Volkswagen Golf are important pillars in the history of the German manufacturer Volkswagen and have dominated the automotive markets in their respective segments. They represent two different design and engineering philosophies, adapted to the varying needs of consumers (PETRESCU ET.AL. 2011).

#### • Volkswagen Golf E4

• The Volkswagen Golf is undoubtedly one of the most popular and influential passenger cars in the world. Since its launch in 1974, it has defined the compact class (hatchback) and set benchmarks for reliability, functionality and handling (Gheorghe Frățilă, ET AL, 2007).

• Golf E4 (fourth generation) was produced between 1997 and 2003. This generation was praised for its superior build quality, modern yet conservative design, and a wide range of engines. It was a transitional model, bringing significant innovations over previous generations, but which, with the Euro 4 pollution standard, lags behind newer technologies in terms of emissions (NEGREA, V.D., ET AL, 2004).

#### Volkswagen Passat E6

The Volkswagen Passat is an upper-middle-class (family) model, recognized for its comfort, generous interior space and quality finishes. It served as a more affordable alternative to premium brands, offering a refined driving experience and an imposing presence. (<https://ptc-auto.ro/blogs/masina-mea/istoria-volkswagen-o-poveste-de-succes>)

Passat E6 (sixth generation, also known as the B6) was launched in 2005 and brought a completely new design, advanced safety systems and a modern engine range. (<http://www.volkswagen.de>) By complying with the Euro 6 pollution standard, this model integrated state-of-the-art technologies for reducing emissions, reflecting the manufacturer's commitment to stricter environmental regulations. In short, the two vehicles are representative of Volkswagen's strategies from different periods. The Golf E4 symbolizes the evolution of the compact model, while the Passat E6 illustrates technological progress and a step towards more environmentally responsible mobility (URICANU, N., ET AL., 2011)

### • Material and method

The technical inspection is performed only on road vehicles that are presented with:

-the registration certificate or the replacement proof of the registration certificate, issued by the police (duly completed with the data necessary for identification); -the vehicle's identity card. The order of execution of the specified operations will be established by each station according to its own technological flow, except for identification, which will be the first operation performed. For each road vehicle presented for the technical inspection, a technical inspection report is completed, corresponding to the category of the road vehicle. The technical inspection report is recorded in the computer and in the Register of evidence of technical inspections (until the date established by the Romanian Auto Registry).

Road vehicles presented for the technical inspection must be clean, especially the body, chassis, assemblies and subassemblies to be checked. They must be presented with tires inflated to the nominal pressure.

### • Results and discussions

• To compare the emissions of the Volkswagen Passat E6 and the Volkswagen Golf E4, we need to look at the technical specifications and emission standards of each model.

#### • Volkswagen Passat E6

• Emission standard: Euro 6

• Engine: Available in various petrol and diesel variants, each with different CO2 and NOx emissions.

• NOx emissions: Euro 6 diesel models are designed to have low nitrogen oxide emissions, usually below 80 mg/km, but these values can vary depending on the engine and exhaust gas treatment technology (e.g. use of the SCR system with AdBlue).

#### Volkswagen Golf E4

Emission standard: Euro 4

Engine: Also available in petrol and diesel variants, but with older technologies.

NOx emissions: Euro 4 models have higher NOx emissions compared to Euro 6, usually around 180 mg/km for diesel models.

#### Comparison

Emissions control technology:

The Passat E6 uses advanced technologies to reduce emissions, including particulate filters and SCR systems.

Golf E4, fiind un model mai vechi, are tehnologii de control al emisiilor mai puțin eficiente, ceea ce duce la emisii mai mari de NOx.

#### Environmental impact:

The Passat E6 contributes to lower pollution due to stricter emission standards, making it more environmentally friendly.

The Golf E4, with higher NOx emissions, has a higher environmental impact.

#### Regulations and taxes:

In most countries, Euro 6 vehicles benefit from lower taxes and incentives for low-emission vehicles, while Euro 4 vehicles may be subject to higher taxes and restrictions in cities.

### • Conclusions

Although both models marked important eras in Volkswagen history and were appreciated for their reliability and quality, the Volkswagen Passat E6 is clearly superior in terms of environmental performance. This superiority is due to the Euro 6 pollution standard, which imposes much stricter limits on emissions, compared to the Euro 4 standard of the Golf E4.

Thus, the major difference between the two cars lies not only in the different class (family vs. compact), but, more importantly, in the exhaust gas treatment technology, which has evolved significantly between the years of production of the two models.

Consequently, the Passat E6 represents a more environmentally responsible choice and, in the long term, may be more economically advantageous, by avoiding the high taxes and traffic restrictions imposed in certain cities on more polluting vehicles.

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