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DIAGNOSIS OF DIESEL VEHICLES USING MODERN DIAGNOSTIC SOFTWARE

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Summary: *During the working of diesel engine emissions of harmful effects occurring gases that have a major impact on the environment. As the increasingly stringent emission requirements of motor vehicle manufacturers are forced to develop better systems of modern technological and structural solutions to reduce emissions. For a reliable assessment of possible malfunctions of the module of a motor vehicle required the possession of the appropriate diagnostic equipment and competence of professionals. At the end of the work was performed system testing of exhaust gas truck using modern diagnostic equipment.*

Key words: *Standard, emissions, diagnostics.*

1. INTRODUCTION

Determining the condition of the vehicle is one of the main tasks to be solved in the framework of their maintenance. In this particularly important role has the ability to identify different types of events that changes the situation. Applying diagnostic method determines the actual state of the vehicle. Diagnosis is the first phase of each vehicle maintenance operations. Vehicle diagnostics is the process of determining its status and making assessments of the condition, based on the registration of symptoms, including in three basic stages [1]:

1. Determination of the deviation of diagnostic symptoms and parameters of their nominal value;
2. Analysis of the nature and causes of deviation diagnostic symptoms and parameters of the nominal value;

3. Determination of the characteristic size of operation without failure occurrence (mileage, number of hours worked).

With today's modernization of the automotive industry, motor vehicles are equipped with modern electronic devices that can detect possible malfunction of individual modules and the system as a whole.

A parto ot the Euro 3 legislation is EOBD (Euro-On-Board-Diagnostic) opposite the American system diagnostics OBD (On-Board-Diagnostic) with the help of which one can exert control system of a motor vehicle, as well as specific modules, such as the exhaust gas system.

A diagnostic system in a motor vehicle can monitor, self-diagnostics, a record in electronic form and communicate with the "outside world".

EOBD Diagnostics currently has 9 prescribed diagnostic modes: reading parameters, reading the conditions of work, reading errors, erase errors and diagnostic data, test results lambda probes, the results of periodic tests of components, the results of continuous provođenih tests components, results management system and components and vehicle data.

In order to optimize the required conditions, to increase performance and efficiency of the engine in a motor vehicle built-in computer system which consists of a control unit labor ECU (Engine Control Unit) with its integrated software, sensors and actuators. Engine running under constant surveillance sensors that work by a control unit ECU by processing at high speed all the available information and data affecting the operation command process actuators. ECU also continuously during operation monitors operating parameters and sends the data to the instrument panel where you can read the necessary data.

2. SELECTIVE CATALYTIC REDUCTION

During the operation of the diesel motor vehicles formed particulates (PM), unburned particles of hydrocarbon (HC), carbon dioxide (CO2) and carbon monoxide (CO), which is oxidized with nitrogen after that generated nitrogen oxides (NOx), that are considered the main polluter of the environment. In order to reduce emissions of European legislation is a legal and institutional framework to regulate the limits of emissions in different terms of use of motor vehicles through the Euro emission standards. Emission standards regulate a significant reduction in nitrogen oxides (NOx) emission of motor vehicles (Table 1).

To achieve stricter norms of emission reductions leading manufacturers of heavy duty diesel vehicles opted for the use of DPF (Diesel Particulate Filter) particulate filter and EGR (Exhaust Gas Recirculation) technology to achieve Euro 4 and SCR (Selective Catalytic Reduction) technology to achieve Euro 5 standards.

DPF (Diesel Particulate Filter) filters harmful particles are removed by filtration of exhaust gases. PDF filter regeneration can be passive, self ignition at high temperature and active over ECU fuel injection into the exhaust system.

EGR technology is based on the principle of work recirculation of exhaust gases into the engine via the EGR valve and the intake manifold. EGR valve

managed broadband lambda probe, which performs analysis of exhaust gases through the lambda sensor.

Table 1. Emission Standards diesel freight vehicles

Euro standard		Emision limits (g/kWh)			
		CO	HC	NO_X	PM
Euro 4	January 2005	1.5	0.46	3.5	0.02
Euro 5	September 2009	1.5	0.46	2.0	0.02
Euro 6	September 2013	1.5	0.13	0.4	0.01

SCR technology uses AdBlue synthetic solution (32,5% urea and 67,5% NH_3 H_2O) for selective catalytic reactions to reduce NOx emissions of motor vehicles. The above solution called AdBlue is a trademark of VDA (Verband der Automobilindustrie) that is used in Europe and Asia, while in North America uses the name DEF (Diesel Exhaust Fluid) and AUS32 (Aqueous Urea Solution). Quality synthetic AdBlue solution has been defined by ISO 22241 and DIN 70070. AdBlue has been injected into controlled from a separate reservoir in harmful exhaust gases in a chemical reaction with nitrogen oxides (NOx) that creates nitrogen (N_2) and water vapor (H_2O), as the chemical element of air that we are breathing (Figure 1).

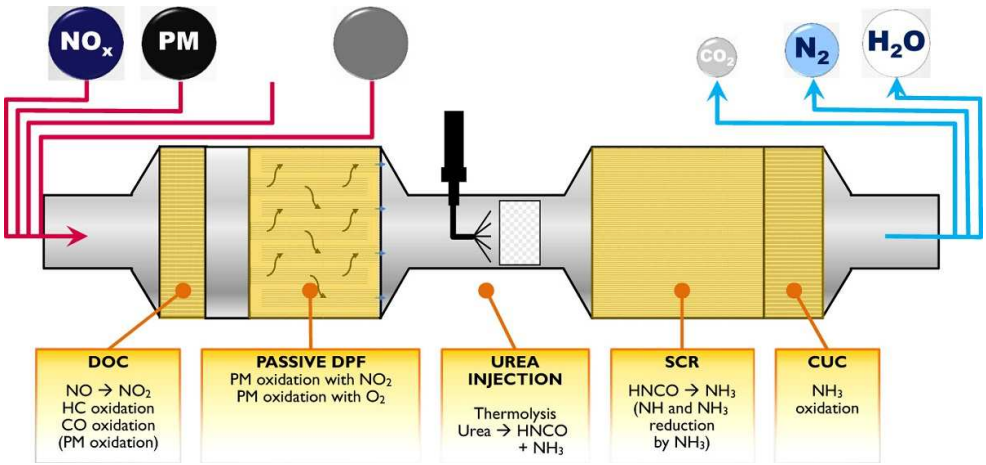

Figure 1. Selective Catalytic Reduction [2]

In accordance with the standards of today's share exclusive uses multiple catalysts triple effects on particles of hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxides (NOx) and particulate filter to reduce greenhouse gas emissions.

Chemical reactions in catalysts triple facts may be summarized by the formula of chemical reactions:

Oxidation reaction :	$2\ NO + O_2$	→	$2\ NO_2$
	$2\ CO + O_2$	→	$2\ CO_2$
	$4\ HC + 5O_2$	→	$4\ CO_2 + 2\ H_2O$
Hydrolysisi reaction :	$CO(NH_2)_2 + H_2O$	→	$2\ NH_3 + CO_2$
SCR reaction :	$4\ NH_3 + 4\ NO + O_2$	→	$4\ N_2 + 6\ H_2O$
	$8\ NH_3 + 6\ NO_2$	→	$7\ N_2 + 12\ H_2O$
	$2\ NH_3 + NO + NO_2$	→	$2\ N_2 + 3\ H_2O$
Oxidation reaction :	$4\ NH_3 + 3\ O_2$	→	$2\ N_2 + 6\ H_2O$

3. APPLICATION OF MODERN DIAGNOSTIC SYSTEM

Successful implementation of modern diagnostic systems required to meet specific technical requirements, that are based on the technical characteristics of the used equipment and the technical education of the staff. Previous conditions can be grouped into its three main groups [3]:

- a motor vehicle has been required to be equipped with all the necessary electronic elements necessary for performing diagnostics (encoders, sensors) and the central computer located in the vehicle and that is directly or indirectly connected with all electronic elements,
- it is necessary to possess a diagnostic tool that provides special cables connected to the conveyor means,
- the worker who performs jobs diagnosis is well-trained to perform vehicle diagnostics using the available modern diagnostic system.

The work has been carried diagnosing AdBlue system of heavy goods vehicles Euro 5 class with integral diagnostic apparatus protected Software E.A.SY. that has been developed by IVECO. Software E.A.SY. here represents a commercially-protected program for processing of diagnostic data that is using by authorized personnel (Figure 2).

Applying the actual diagnostic equipment during the test failures can be located with the required accuracy at a given time and in different places, whether they are mechanical or electrical.

Before you run diagnostic checks must first diagnostic device connected to the motor vehicle via DLC connector. After that was launching commercially through the VIN code protected E.A.SY the software which forms an integral part of the diagnostic device. In the drop-down menu selection is made by the type of vehicle and the type of database and the required test system AdBlue selective catalytic reduction of emissions (Denoxtronic 2).

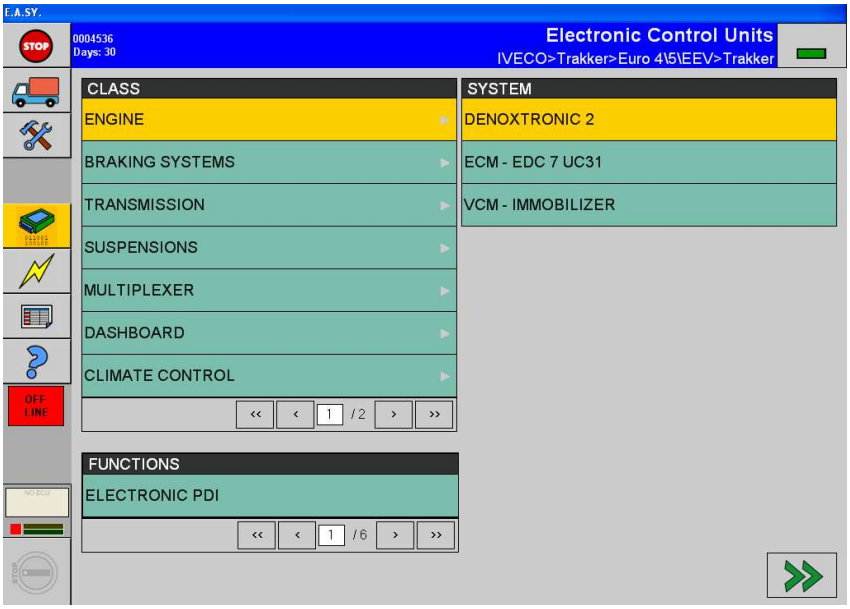

Figure 2. Software E.A.SY.

Diagnostic device over ECU takes control of the engine by running actuators and measurement parameters via sensors on the state of AdBlue system after a given procedure. During testing AdBlue system diagnostic device exerted continuous monitoring and recording of all measurable parameters of the system changes.

After the testing of the AdBlue system of a motor vehicle through diagrams work out a deviation parameter of work in a given time interval. On the basis of information obtained from the diagnostic device and the analysis diagrams work AdBlue system has been located a possible mechanical failure (Figure 3).

Locating a possible fault AdBlue system technician is to review and correction of irregularities that were acquired for rediagnostic testing Heavy Vehicle.

Re-testing diagnostic device equipped with AdBlue system are determined by the appropriate parameters of actuators and sensors (Figure 4).

4. CONCLUSION

The paper deals with the reduction of harmful emissions in diesel motor vehicles in accordance with accepted Euro emission standards.

Tests has been conducted, determining the condition and location of the possible cause of the malfunction AdBlue system Heavy Vehicle class Euro 5 using modern diagnostic equipment.

Development and modernization of the automotive industry, reduces border emissions, providing the required level of safety and reliability of the vehicle imposes the need for continuous development and improvement of diagnostic devices and sophisticated tools.

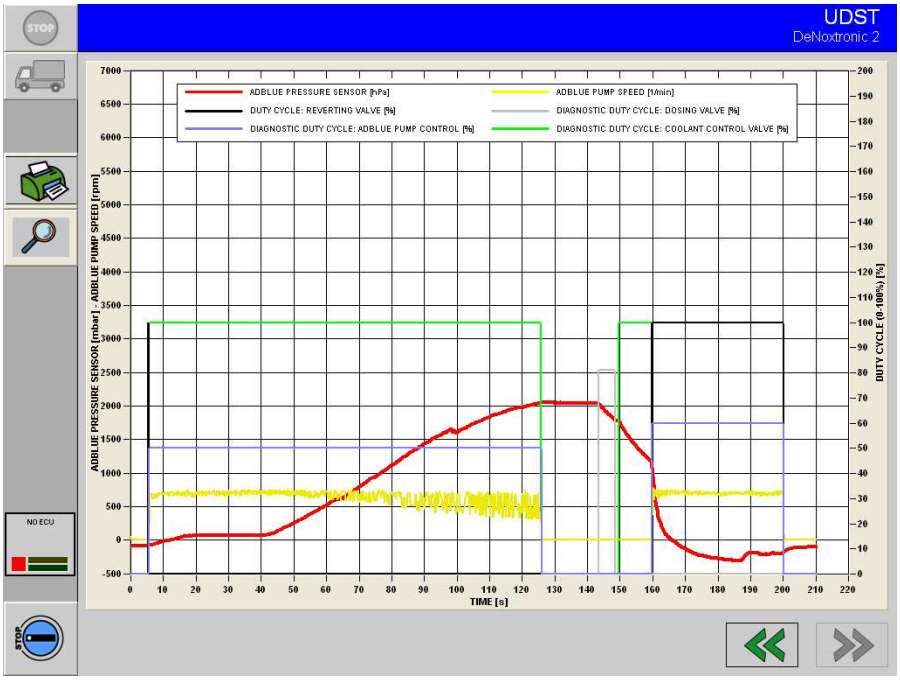

Figure 3. Faulty system

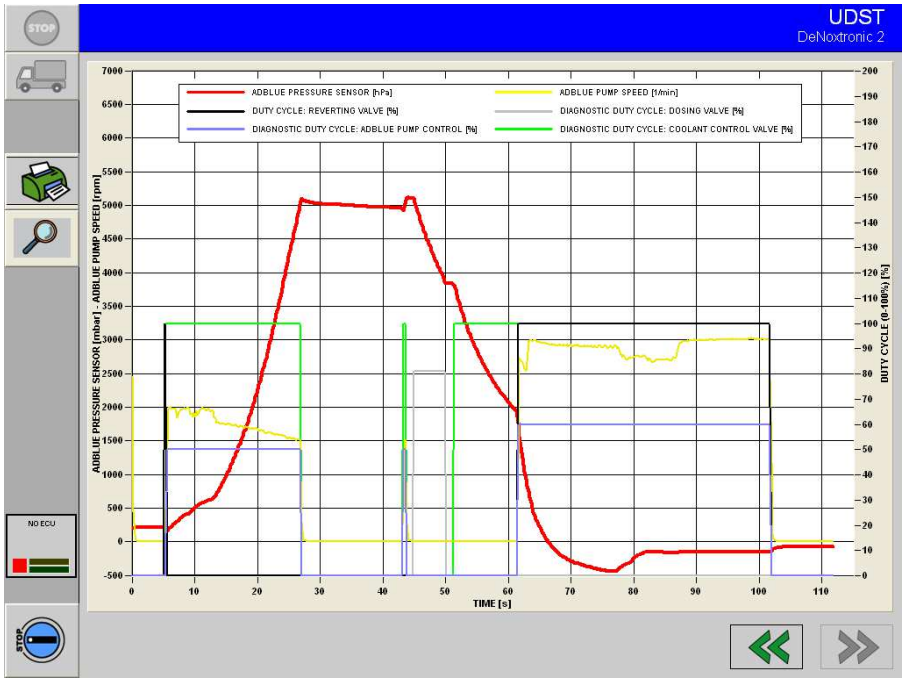

Figure 4. Proper system

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