OBD EURO VI CHALLENGES IN BRAZIL

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ABSTRACT

Exhaust emissions control remains a problem for all combustion engines, whether Otto or diesel. Due to the implementation of increasingly stringent environmental regulations, manufacturers have incorporated into the car several systems for reducing emissions of polluting gases. One of the pollutants that is part of the engine emissions is NOx, which is chemically formed by the interaction of nitrogen and oxygen molecules due to the high temperature inside the combustion chamber.

New technologies such as the SCR catalyst with noble materials and the DPF filter have a reducing emission to extremely low levels, which makes it difficult to monitor due to smaller tolerances. Thus, the use of closed-loop control strategies becomes mandatory to ensure the functions and operation of the emission monitoring system (OBD).

One of the major challenges for the implementation of the new Euro VI engines in Brazil (Proconve P8 regulation) will be precisely to guarantee the functionality and robustness of the OBD system considering specific characteristics of the South American market as fuel with high content of biodiesel and / or sulfur, which cause early reduction of oxidation catalyst (DOC) efficiency and consequently SCR efficiency loss.

INTRODUCTION

The Euro VI regulation requires a highly complex OBD system. In order to avoid the impact during its implementation, the requirements were divided in phases of implementation ensuring a better adaption of the users and assimilation of the new technologies by the manufactures. The differences between phase A (Phase-in) and phase C are described below. In Brazil the level of requirements of the new regulation Proconve P8 are similar to Phase C:

- The OBD Threshold Limit for NOx emission on phase A (phase-in) is 1500 mg/kWh and on phase C is 1200 mg/kWh;

- The monitoring of DPF performance shall be performed through the DPF presence in the after-treatment. The system evaluates the pressure difference to validate the presence of the DPF in phase A (phase-in). Phase C needs to guarantee the value of the particulate matter is below the 25 mg/kWh (PM OTL) during the all WHSC and WHTC operating cycle or install the particulate material level sensor on the DPF;

- IUPR is not required on Phase A (phase-in), but the performance must be monitored and surveys must be submitted twice every 9 months. Phase C stablishes a minimum IUPR value of 0.1 (10%) for approval.

EURO VI	A	B	C	D
NO_x OTL	**1500 mg/kWh**		**1200 mg/kWh**	
PM OTL	**25 mg/kWh** – Performance Monitoring		**25 mg/kWh**	
CO OTL (only PI engines)	-	**7500 mg/kWh**		
IUPR Adoption of in-use performance ratios. IUPRs give an idea of how often the conditions subject to monitoring occurred and how frequently the monitoring was conducted	**Phase In.** Not required to comply with minimum in-use performance ratios. Assessment: survey program including at least two in-use performance surveys, each of 9 months duration to be completed Jul.2015		**Final:** **minimum of IUPR = 0.1** **(or 1 in 10 times)**	
Reagent quality manufacturer shall specify a minimum acceptable reagent concentration. CDmin, which results in the tailpipe emissions specified	**Phase In:** **NOx reference for Demo-Test:** **900 mg/kWh**		**Final:** **NOx reference for Demo-Test:** **460 mg/kWh**	
Reagent consumption Driver warning if deviation between reagent consumption and demanded consumption	**50%**			
Additional OBD monitors Focus on long-term effects, for example clogged or soiled injectors	-	-	**Additional OBD monitors to be implemented**	

Figure 1 – Comparison between the OBD Euro VI phases

MAIN SECTION

WWH-OBD means World Wide Harmonized On-Board Diagnostics for the worldwide standardization of vehicle diagnostics, passenger car emissions monitoring, and commercial vehicles.

The creation of WWH-OBD was initiated by the United Nations and was adopted as Global Technical Regulation (GTR) Nº 5. The main focus is the relevant diagnosis for diesel vehicle emissions.[3]

The purpose of WWH-OBD is to replace the regional vehicle diagnostic standards for emission monitoring, in order to create a global on-board diagnostic (OBD) standard. However, it is not intended to standardize the emission of pollutants limit, but mainly the emission operation control and the vehicle communication interface. The emission limit values for vehicles remain the responsibility of the regional regulatory agency. [3]

For the creation of the WWH-OBD standard, the United Nations standardized with ISO, which is describing the WWH-OBD standard processes. ISO standards for vehicle diagnostics are used (eg. ISO 15031) or added, such as ISO 14229 or ISO 15765. For the WWH-OBD requirements implementation, ISO 27145 has been reinstated. [3]

It is also a tendency to implement the system focusing on the actual operating conditions of the vehicle. The great concern is simulate the current condition of the vehicle, the system must be homologated in stationary cycles (WHSC) and transient cycles (WHTC) including the cold start emission certification process. All of that is to homologate of the engine with actual vehicle condition.

The WHSC is a stationary dynamometer programming defined by the Global Technical Regulation (GTR) Nº 4 developed by the United Nations. The GTR covers a worldwide harmonized heavy-duty certification (WHDC) procedure for exhaust engine emissions. Two test cycles, a stationary test cycle (WHSC) and a WHTC with cold and hot start requirements, were developed covering typical driving conditions in the European, USA, Japan and Australia.

The WHSC is a steady-state test cycle with a test mode sequence with speed and torque criteria in each mode and ramps defined between these modes. Its total length is 1895s (including the 20s ramps) and the emissions are continuously sampled.

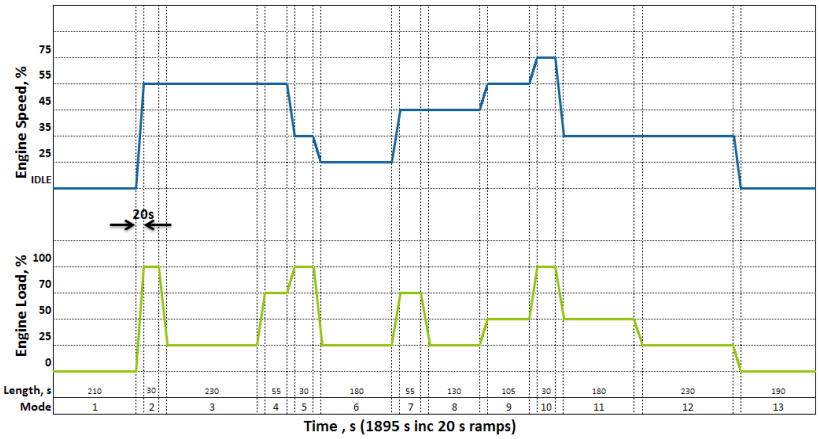


Figure 2 – WHSC Cycle

The main difference between the ESC and WHSC cycles is the addition of one low idle mode and one low load mode, consequently decreasing the total cycle work and leading to a colder exhaust gas. The low engine load does not heat up the exhaust system and thus makes it difficult to meet emissions compliance because the NOx level is too high and urea injection is insignificant to reduce NOx emission. In the ESC Cycle there are weighting factors for each steady mode for emission calculation, but there may be some low load regions that have a small weight factor and will not greatly influence the test result. The WHSC cycle does not require weighting factors, the emissions are constantly sampled and cumulated, so that high emission values will directly influence the result of the emissions test.

The WHTC is a transient test with three different segments: Urban, rural and highway. Its total length is 1800 seconds, the emissions are continuously sampled and the final emission value is calculated as a weighted average between a cold start cycle (weighting factor 1/7) and a hot start cycle (weighting factor 6/7).

$$\text{Emissions Average} = \frac{(\text{WHTC Hot} \times 6 + \text{WHTC Cold} \times 1)}{7}$$

The ETC cycle is performed with the warm engine to stabilize the emission values. The NOx values are very high when the engine is cold because it does not have urea injection. The emissions result in the cold start will have a factor in the final emissions result in the WHTC cycle in order to represent the real engine condition. The thermal management strategy is very important to heat the engine as fast as possible to improve the emissions result in cold start.

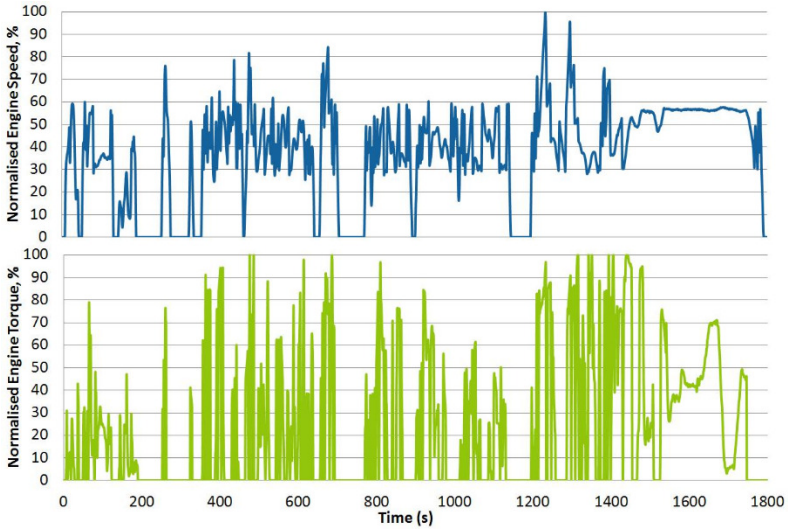


Figure 3 – WHTC Cycle

The ETC cycle time is divided in 600 seconds for the urban cycle, 600 seconds for the rural cycle and 600 seconds for the road cycle. The main difference between the WHTC and ETC cycles is the duration time in the WHTC cycle, because this cycle works with lower load factor and lower exhaust temperature due to the fact of working more time in the urban cycle where the load factor is about 40% lower than the ETC cycle.

The emission limits of the Euro VI (Proconve P8) regulation requires manufacturers to use new exhaust gas recirculation (EGR), selective catalytic reduction (SCR), diesel oxidation catalysts (DOC) and diesel particulate filters (DPF) increasingly effective and sophisticated emissions reductions in diesel vehicles, but new and challenging requirements have been implemented to address potential shortcomings of previous regulations, including:

- In-use Performance Ratio (IUPR) with a minimum frequency of 10%;
- Anti-tampering control system with the vehicle speed limitation at 20 km/h when the reagent level is empty or after a period of time with active fault code;
- Monitoring of reagent liquid concentration (Arla 32) in order to detect increase of NOx emissions above the level 0.46 g/kWh;
- Monitoring system demonstration for long-term injector deviations.

On-board Diagnostic (OBD) requirements for heavy vehicles involve the monitoring of components and subsystems. Although some components can be monitored continuously, but subsystems need robust monitoring to evaluate the frequency of control functions (called "monitors") of each subsystem to ensure fault detection and avoid false approval and false indication of failures when the vehicle is operating correctly. Therefore, the manufacturer shall define conditions under which emission control components and subsystems can be monitored for proper operation.

The adoption of in-use performance ratio (IUPR). The IUPR monitors how often OBD monitoring occurs and how it was performed. The Euro VI regulation (Proconve P8) establishes a minimum of IUPR = 0,1 (1 complete diagnosis in every 10 cycles).

$$IUPR = \frac{\text{Event Counter (Quantity) Monitoring Completed}}{\text{Counter of Driving Cycles}}$$

The purpose of the IUPR is to show the frequency of activation of the OBD monitoring system "Monitoring of monitoring". Four types of indicators are calculated:

- **IUPR (individual):** is the index of each monitoring function (monitor), calculated through a numerator / denominator relation. The numerator is an event counter (quantity) monitoring, incremented whenever the monitor was actually performed. And the denominator is a counter of driving cycles that would meet the monitoring conditions. Remembering that to increase the denominator, the vehicle needs to achieve some conditions to validate the driving cycle.

- **IUPRg (group of monitors):** is the index of each group of monitors of a certain subsystem of emission control. The standard specifies 7 groups of monitors in the diesel engines, one for each emissions control subsystem. Within these groups are the individual monitors of each fault (for example, in the DPF system monitors, they would be monitoring substrate absence, monitoring of clogging, among several others). The IUPRg of monitors group is considered the lowest of all monitors in this group. The minimum value is 0.1, so if all monitors are in a ratio greater than 0.1 and only one monitor is below this limit, then this group will fail.

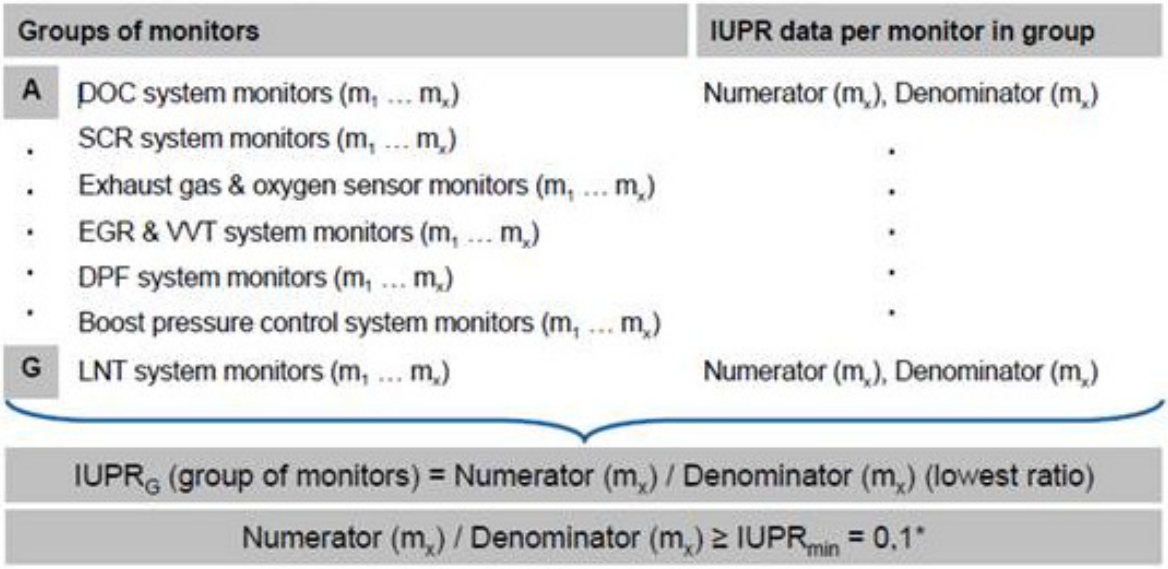


Figure 4 – IUPR monitors group

- **IUPR vehicle (IUPR of a vehicle):** is the final IUPR index of a vehicle, considered as the lowest value among all IUPRg of this vehicle.

- **Final IUPR (segment):** is the IUPR values average of all vehicles in the same segment. The standard establishes 6 vehicle segments and the evaluation is done in at least 15 vehicles of each segment (long-haul truck, distribution truck, other truck, inter-city bus, city bus, other bus), and the selection of vehicles must be performed according to market share. The final IUPR (vehicle segment) is defined by the average vehicle IUPR within each segment. This mean has to be greater than 0.088 (88% minimum IUPR - 0.1) and 34% of vehicles must have the vehicle IUPR greater than 0.1.

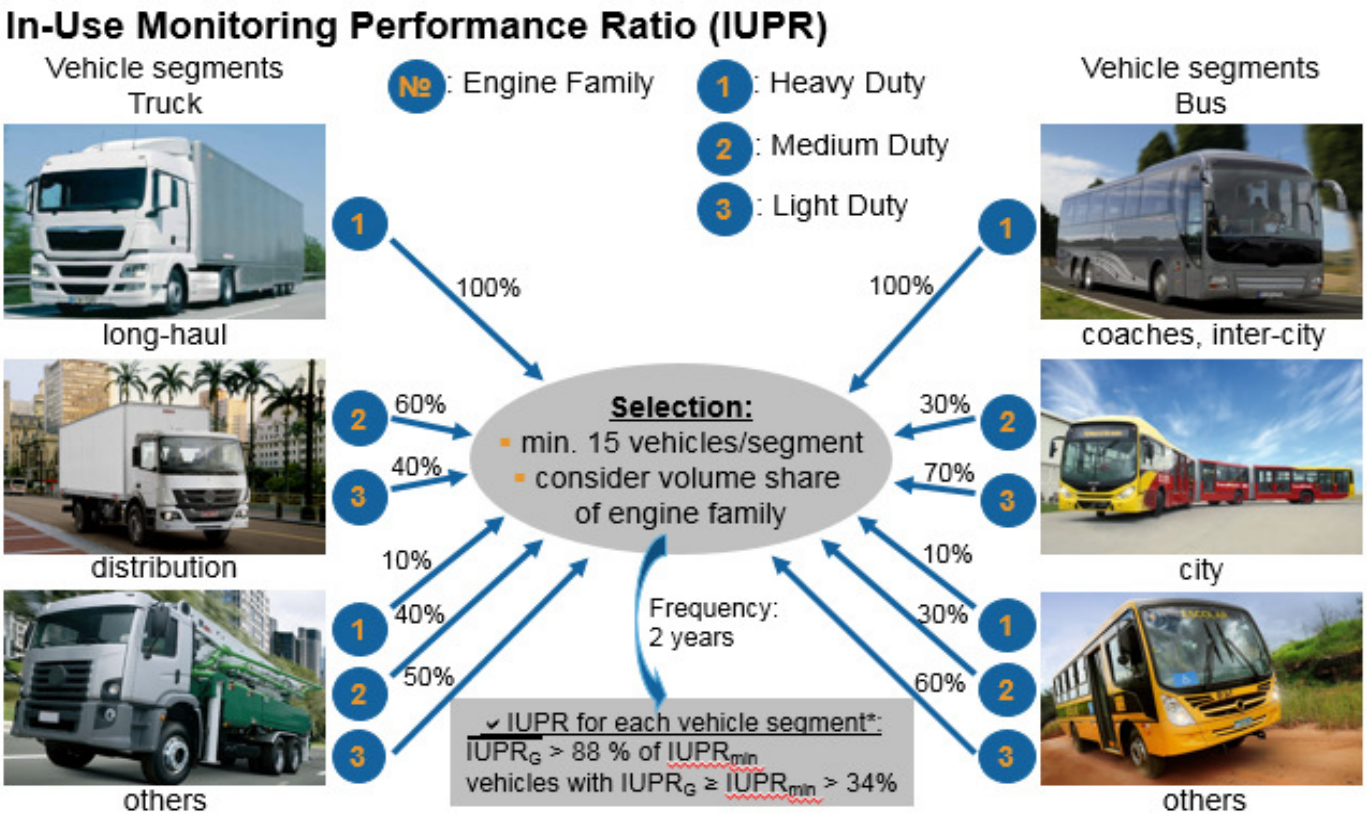


Figure 5 – IUPR assessment example by vehicle segment

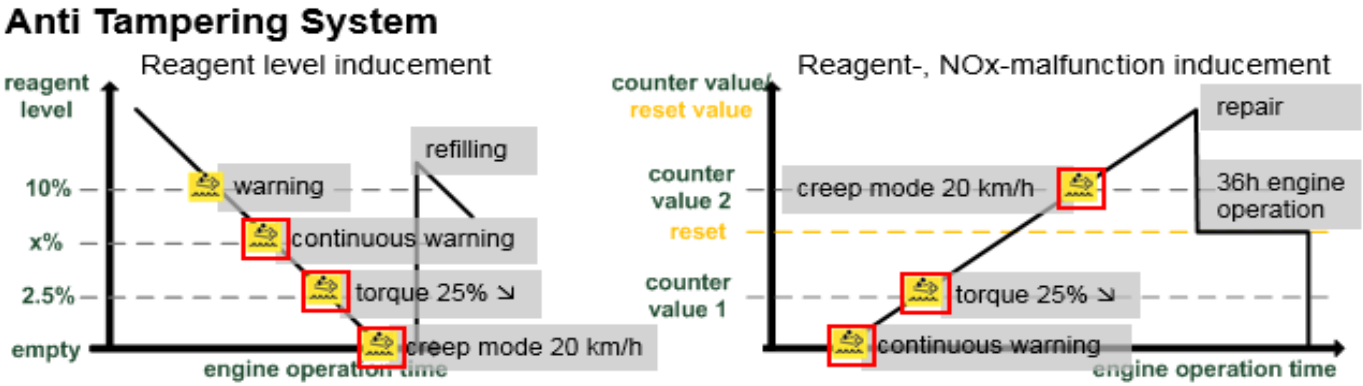
For the continuous quality of the OBD system, every manufacturer must report the average IUPR on all monitoring groups and all vehicles in operation at a frequency of 2 years. For this, a representative sample of trucks based on the greatest market share should be chosen. Your IUPR data must be selected and reported. The sample shall contain different categories of vehicles in a distribution proportional to the original market distribution. If the average IUPR falls below the predetermined limit value, the manufacturer undertakes to correct the affected OBD system and update the vehicles in production. If this happens again, the manufacturer is called to remove the vehicle from the market; this means that the approval for this type of vehicle will be revoked.

OBD requirements are no longer restricted to the vehicle. Data must be selected and collected regularly in a database so that the required analysis can be performed. Each diagnostics system must be expanded by the functionality of reading the IUPR data and transfer functionality to a database. In addition, it should be guaranteed that the data is reliably selected on all vehicles entering the dealership. This is achievable by user instructions or performed routines (for example, an annual maintenance).

The IUPR will be critical in an urban vehicle in regions with high car traffic and low load factor because it will not reach the temperature to inject Arla 32 into the aftertreatment system and consequently will not reach the boundary conditions to start monitoring the OBD system. Manufactures will have a major challenge in engine development to ensure that OBD monitors operate under these critical conditions where the aftertreatment temperature is low, but an alternative is to optimize engine thermal management with the intention of engine works in a range ideal under low load conditions. Remembering that the IUPR is mandatory for Proconve P8 engines.

Another new requirement on Euro VI regulation (Proconve P8) is the vehicle speed limitation "Creep Mode". A comparison between the Euro V (Proconve P7) and Euro VI (Proconve P8) standard will make it easier to understand the induction differences. The Euro V engines (Proconve P7) use a limitation of 75% of the maximum torque (reduction of 25% of the maximum torque) when the vehicle

with GVW up to 16 ton and a limitation of 60% of the maximum torque (reduction of 40% of the maximum torque) when the vehicle with GVW above 16 ton. The Euro VI engines (Proconve P8) uses different induction strategy, in the first phase is applied a 75% limitation of maximum torque (25% reduction of maximum torque) when the counter reaches a certain period for each failure type or low reagent level (<2.5%). The second phase will be applied to limit the speed of the vehicle in 20 km/h when the fault counter reaches a determined period greater than the first stage or empty reagent level. Fault repair allows to turn-off MIL lamp and remove torque or speed limitation. The fault counter remains in repair reset value in the given period for each fault type during 36 hours to confirm that the repair was performed correctly. After the 36 hours period, the counter will reset to zero if the fault is not active before the 36 hours period. If the fault is active within the 36 hours period, the MIL lamp will turn-on in the panel and the torque will be limited in 75% (25% reduction of the maximum torque), then the driver will have a shorter time otherwise the speed limitation of the vehicle in 20 km/h will be activated.



Reagent level/ Reagent or NO_X-malfunction	1st Warning	Contin. Warning	1st stage Inducement	2nd stage Inducement	Reset value Repair
Low reagent level	level < 10%	level < X%	level < 2,5%	tank empty	dep. on refill
Low quality, NO_x > ETL (0,9g/kWh*)	n/a	DTC c&a	counter ≥ 10h	counter ≥ 20h	counter = 18h
Dosing interruption	n/a	DTC c&a	counter ≥ 10h	counter ≥ 20h	counter = 18h
Consumption deviation > 50%	n/a	DTC c&a	counter ≥ 10h	counter ≥ 20h	counter = 18h
EGR valve impeded	n/a	DTC c&a	counter ≥ 36h	counter ≥ 100h	counter = 95h
Monitoring System Malfunction	n/a	DTC c&a	counter ≥ 36h	counter ≥ 100h	counter = 95h

Figure 6 – Induction level for each fault type

The "Creep Mode" speed limitation mode will be activated if one of the following conditions is present or is satisfied first:

- The vehicle is stopped for more than one hour;
- The engine is restarted;
- Refueling the vehicle;
- The vehicle is stopped and the engine has been running for 8 hours with the request for the creep mode, but never activated.

The purpose of the "Creep Mode" speed limitation is to force the driver to perform fault repair and to ensure that the engine meets the emission limits. Limiting 75% of maximum torque (25% reduction of maximum torque) will not have a significant effect when the vehicle is working with low load factor or routes within the city. The impact of the speed limitation at 20 km/h will be very critical if the vehicle achieves this condition. The intention is to force the repair of the vehicle but if it is not done correctly and the fault returns within 36 hours then the driver will be penalized and will not be able to return to the dealership that performed the repair of the vehicle. It is very important in performing the

maintenance and repairs at a reliable dealership to avoid inconvenience of penalizing the driver during normal activity. The impact on speed reducing of the vehicle on the highway or with heavy traffic will be huge because the vehicle will have to move to a nearby dealership and this will disrupt traffic and penalize other drivers. We have to train the dealership network to show how important it is to do a good job the first time because the speed limitation will increase the service cost and the vehicle will have to be towed to the dealership.

The quality of the liquid reagent (Arla 32) will be a new function for Proconve P8 engines in which the system will evaluate the urea concentration in Arla 32. The Arla 32 concentration monitoring must be able to detect quality based on the level of NOx above 460 mg/kWh.

Urea available in Brazil for other purposes has no relation to Arla 32. In addition, Arla 32 uses demineralized water in composition. Common drinking water cannot be used as it contains minerals. The use of any type of liquid solution in the Arla 32 tank could seriously damage the catalytic converter and could even lead total loss, resulting in a significant increase in NOx emissions. Arla 32 has a validity of 12 months when maintained in average temperatures until 30ºC and of 6 months when maintained in average temperatures above 30ºC. Exposure to sunlight should be avoided.

The Arla 32 storage in warehouse will be a challenge for the gas stations because it can decrease the Arla 32 validity, if it is not stored properly. There is no way to know if the Arla 32 is within the specifications to meet the emission limits. The Arla 32 quality will depend on the storage process. If Arla 32 loses its chemical properties to interact with the NOx gases, the Arla 32 quality sensor will identify a poor concentration urea and consequently the NOx value will exceed the 460 mg/kWh. There are some drivers have the consent that they are trying to tampering the system in order to save on the money, but there are other drivers have no idea about the product quality which they purchased at the gas stations and will be relying on the quality of the product sold in the establishment. If there is a poor concentration detection of the Arla 32 in the tank. The MIL lamp will be triggered and the respective fault indicated on the panel.

When the system detects poor concentration of urea, the MIL lamp will be triggered and start the counter of 10 hours in order to trigger the first level of the induction (75% limitation of maximum torque). The second level of the induction will be the speed limitation at 20 km/h and will be triggered after 20 hours of the quality Arla 32 fault is active and confirmed. The repair will be done and the fault counter will remain locked for 36 hours. If the fault does not return within 36 hours then the counter will reset.

Tampering technology or substance designed to reduce environmental pollution is considered an environmental crime. The Arts. 68 and 71 of Federal Decree Nº 6,514, provide a fine if the driver or truck owner is attempting to tampering the emissions monitoring system, The amount of trucks and buses in Brazil are very large and there is great difficulty and equipment of the highway police in monitoring all vehicles on the highways. The purpose of the Euro VI engines (Proconve P8) is to implement a system that monitors the actual condition of the vehicle in operating cycle.

The vehicle manufacturer in partnership with suppliers of engine parts and aftertreatment that are relevant to the emission control system and subject to failure must work together and develop a standard part (failed part) that represents an aged part and increases the emission values of the engine. The aging process of the parts will be defined between the vehicle manufacturer and the part supplier. These parts are sensors, actuators, EGR, SCR, urea dosing, DPF, injectors, etc. There is a normal aging of all engine components and consequently the clogging and wear of some components that directly affect the engine emissions. The part is still in use condition, but does not meet the emission specifications, therefore the system monitors the components behavior that affect the emissions and ensuring that it is within the emissions limits of Euro VI (Proconve P8).

The procedure to develop failed parts is simulation of some field problems in the emission-relevant parts and evaluate on the dynamometer in order to how damaged the part can be until it reaches the emission limit. The OBD system must be able to detect premature aging of the part and inform the driver through the MIL lamp that the lifespan is over and it is necessary to replace the part. Other conditions anticipate the lifespan of the components and degrade more easily. For instance, the fuel injectors, that their primary function is to provide a high pressure fuel spray in the engine combustion chamber needed to keep the engine running. Fuel quality in all gas stations in Brazil is a concerning because fuel quality affects the performance and emissions engine, therefore the importance of preventive maintenance and fueling with good quality fuel because OBD system will monitor the operation cycle and evaluate if it is needed to replace the part in order to meet the emission compliance. The most critical component in the Brazilian market will be fuel injector, due to some problems encountered in the field related to fuel transportation and handling. These are some of the common problems associated with fuel:

- Poor fuel filtration causes the erosion of the valve positioned within those injectors through which the fuel passes towards the combustion chamber. The fuel often passes through this point at high pressure and any abrasive contaminants carried in the fuel can gradually wear out these valves and make them defective.

- Fuel contamination is cause great damage to the fuel system (injectors, injection pump) when it reaches the high pressure fuel system. Water can reach the fuel through the storage tank of the fuel stations or mix in the fuel during storage and handling if these processes are not conducted properly. Micro particles are a serious contaminant when they enter the fuel and can easily settle into the fuel injector. If the engine does not receive adequate fuel, it will start to vibrate once it finishes one complete cycle. It requires a great deal of fuel and if the fuel injector is unable to deliver that, a detonation may occur causing engine vibration

- The accumulation of debris in the fuel injector can cause clogging or spring locking inside the fuel injector allowing fuel leaking. It will cause disturbance to acceleration, oscillation in low idle, reduce fuel efficiency and will result in power loss.

CONCLUSION

The strict requirements of the Euro VI regulation (basis for the Brazilian Proconve P8 regulation) deal with the actual NOx and PM emissions of diesel heavy vehicles with changes in test procedures in favor of the worldwide harmonized transient cycle, the implementation of maximum number limit requirements and more stringent OBD requirements.

In order to improve the effectiveness of the OBD monitoring functions in the actual operating condition, the IUPR was introduced in order to vehicle manufacturers provides this information for approval authorities about vehicle performance evaluation monitors. The penalty on the vehicle manufacturer to meet the minimum requirement of 10% in order to force in meet the standard requirements and ensure that the vehicle is emission compliance. The requirements require more effort from vehicle testing and continuous monitoring of the fleet of field tests in order to assure evaluation monitors information.

The urea concentration sensor will be a very important function to ensure the quality of the urea injected into the aftertreatment system, but we will have some problems in the field because the handling and storage process of the Arla 32 is done in an inappropriate way and this affect the product validity. The driver can fueling the vehicle with an expired Arla 32 and out of specification chemical properties to perform the chemical reaction within the catalyst. All awareness work at truck fairs and

events to teach the risk of fueling with poor quality Arla 32 and keeping the truck up to date with maintenance will extend the components lifespan and ensure that it meets the emission limits.

A great synergy between the vehicle manufacturer and the parts supplier is very important at the development phase to define the failed parts because it will be homologated by the regulatory agency in order to ensure the robustness of the system if any emission relevant part is damaged and exceed emission limits. The qualification of the service centers will be very important of how to proceed when a vehicle arrives with this type of fault in the workshop. A well-trained team will avoid reworking and wasting parts.

Therefore, to achieve a successful implementation of the WWH-OBD requirements for a future regulation Proconve P8, many evolutions regarding tests capability, access to up-to-date technologies and training of manpower should be considered for both manufacturer and authorities. This is the worldwide trend that Brazil should follow in terms of environmental protection, continuous technological upgrading and improvement of international competitiveness.

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DEFINITIONS, ACRONYMS, ABBREVIATIONS

Arla 32: Automotive Liquid Reducing Agent is an aqueous solution with a concentration of 32.5% with high purity technical urea in demineralized water, according to NBR ISO 22.241. This solution is injected into the exhaust system of vehicles with Selective Catalytic Reduction (SCR) technology to reduce the emission of NOx, according to a process that occurs through the reaction of Arla 32 with NOx, generating water vapor and nitrogen gas, harmless to human health. The product is non-toxic, non-toxic and does not harm health or the environment. The number 32 is a reference to the amount of urea in its composition: 32.5%, diluted in demineralized water [1]

DPF: Diesel Particulate Filter is a filter developed to remove diesel particles from the exhaust gases of vehicles.

SCR: Selective Catalytic Reduction is a means of converting nitrogen oxides (NOx) into water and nitrogen which are inert gases into the environment.

NOx: Nitrogen oxides (NO and NO_2 - NO_X) are known as atmospheric pollutants (primary pollutant and one of those responsible for the acid rains, reduction of the ozone layer and formation of photochemical oxidants – smog). The formation of NO_X in combustion is due to reactions involving basically oxygen and nitrogen from the fuel and can be reduced by acting directly on the operating changes (excess air, power dissipation, recirculation of exhaust gases). [8]

DOC: Diesel Oxidation Catalyst is a type of particulate filter designed to remove harmful emissions from diesel exhaust. The filter is covered with a catalyst, such as platinum or palladium, in which the harmful honeycomb-like exhaust oxidizes. This reduces exhaust pollution, and causes less damage to the environment.

OBD: On-board diagnostic systems monitor the performance of engine and aftertreatment components, including those responsible for controlling emissions. The OBD system is designed to help ensure proper operation of the emission control equipment, alerting the driver in case of malfunctions, so that vehicles meet emissions limits during everyday use. OBD systems are a valuable tool for vehicle owners and technicians, as they supply important feedback about engine maintenance needs and point toward potentially urgent repairs. OBD assists in the service and repair of vehicles by providing a simple, quick, and cost-effective way to identify problems by retrieving vital automobile diagnostics data. OBD systems are also a vital component of inspection and maintenance programs for reducing in-use emissions and cutting down on high-emitting vehicles [6]

WHDC: Worldwide Harmonized Heavy-Duty Emissions Certification.

EGR: Exhaust Gas Recirculation means that part of the exhaust gases is recirculated and mixed together with fresh air from the atmosphere admitted in intake manifold.

WHTC: The WHTC test is a transient programming in the engine dynamometer defined by the global technical regulation (GTR) Nº 4 developed by the group UN ECE GRPE. [3]

WHSC: The WHSC test is a steady state programming in the engine dynamometer defined by the global technical regulation (GTR) Nº 4 developed by the group UN ECE GRPE. [3]

Proconve P8: The Brazilian standard is equivalent to the European standard Euro VI. The Resolution establishes new reductions in vehicular pollution from diesel combustion, caused by agents such as particulate matter, nitrogen oxides (NOx), hydrocarbons and carbon monoxide (CO). All heavy

commercial vehicles sold in Brazil are expected to meet the emission limits set by Proconve P8 as of January 2023, but new truck or bus designs are required to meet the legislation a year earlier in January 2022. [8]

Urea: It is a clear and colorless solution with 32% by mass of high purity urea in demineralized water. The product conforms to ISO22241 standards, highest quality standards and safety. It is a reducing agent of NOx (nitrogen oxide) that can be used to chemically reduce NOx emissions. [2]

GVW: Gross Vehicle Mass is the maximum operating weight/mass of a vehicle as specified by the manufacturer including the vehicle's chassis, body, engine, engine fluids, fuel, accessories, driver, passengers and cargo but excluding that of any trailers.