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ASPECTS REGARDING CONSTRUCTIVE MODIFICATION TO ENGINES FULFILL THE EURO 5 AND EURO 6 DEMANDS TO PASSENGER CAR

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ABSTRACT: The increase of the environment pollution generated by the internal combustion engines the vehicles are equipped with, represent a desideratum both for the manufacturers and for those who use them. The problems generated by this pollution are complex and their causes are various. The paper presents some aspects regards the main constructive modification to engine to achieved regulation adopted by European Commission in sector of automotive industry: air quality regulations (Euro 5 and Euro 6), fuel efficiency and CO_2 regulation. Some engine which equipped passenger car, has major constructive modification to main components of the engine, but it is necessary to complete with some auxiliary components which mean cumulative costs of the engine.
KEYWORDS: pistons, intake manifold, blow by gases

INTRODUCTION

The increase of the environment pollution generated by the internal combustion engines the vehicles are equipped with, represent a desideratum both for the manufacturers and for those who use them. The problems generated by this pollution are complex and their causes are various. In the last decade much of legislation regard air quality has forced technology developments at automotive industry as means to make constructive modifications to the major source of pollution to passenger car. The constructive modifications to the engines are different to diesel engine comparative to spark ignition engine and the costs to achive at this performances are bigger to diesel engine. In this paper are presented some constructive modifications to fulfill the EURO 5 and EURO 6 to diesel engine.

THE RESEARCH METHOD

In this paper are presented some constructive modifications which are maked to the intake manifold and to theblow-by gases recirculation equipment, modifications which are realized on diesel engine.

The major problems to diesel engine concerning to pollution are some aspects regarding to the burning process into the combustion chamber. The mixture air/diesel fuel must be optimum to every operating mode.

For example to the diesel engine for passenger car to achive this goal, the pistons of the engine don't have valve pockets, this measures lead to reduction of space stagnation and the improved the gases flow circulation. The circular motion of the mixture air-fuel is very important to make optimum combustion. The cooling of the pistons are realized with the cooling duct into the piston, the suplimentary cooling are maked with oil which are circulated into cooling duct (Figure 1).

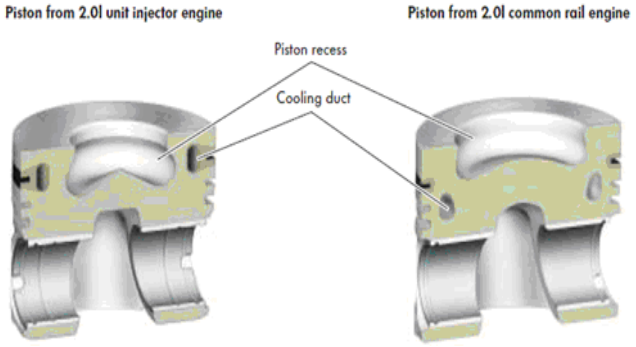

Figure 1. Constructive differences at piston engines [7]

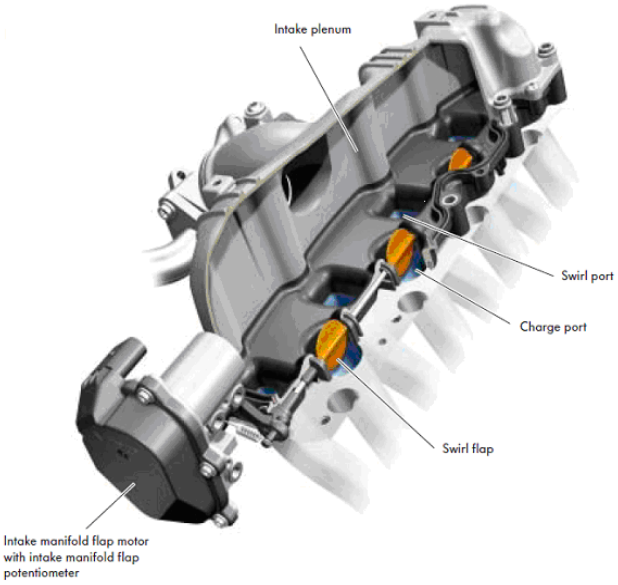

Figure 2. Intake manifold with swirl flap [7]

The pistons are cavity in to the direction of fuel injection and are more flat compared with pistons from unit injector engine. The mixture air-fuel is more homogeneous in this case and the unburning particles are less than comparative unit injector engine.
In the intake manifold it is a swirl flap, which are generated a swirl motion to the intake air by rotation engine. The motion of swirl flap is generated by a sliding rod. The command is generated by electronic unit control (Figure 2).
This swirl flap are closed when the engine are running to low load and low rotation (Figure 3).

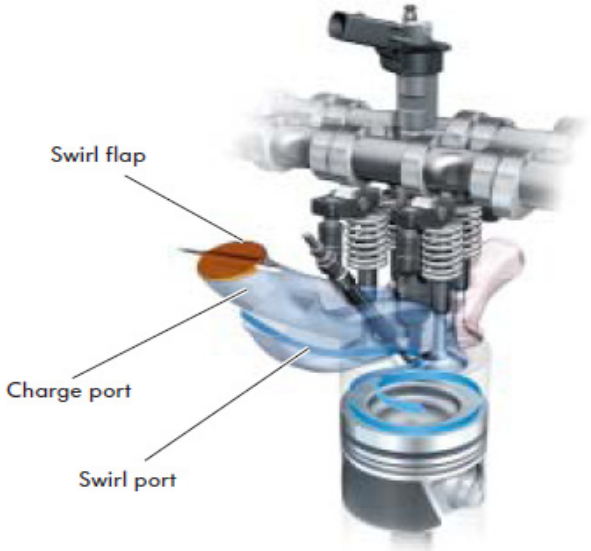

Figure 3. The swirl flap close [7]

In the function of engine the swirl flap are continue adjusted with the rotation engine. There is an optimum position for swirl flap for every operation domain to obtain an optimum combustion. After 3000 rpm the swirl flap are opened, the air circulation is optimum for this operation domain. (Figure 4).

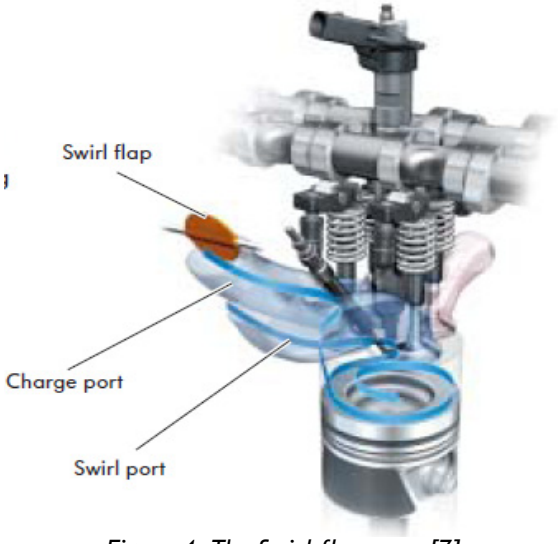

Figure 4. The Swirl flap open [7]

In to the combustion internal engines there is a circulation of the gases between combustion chambers and the crankcase. This circulation are generated by the differences pressure of this volumes, this gases are called blow-by gases. The blow-by gases are containing oil which haven't must burned because generate environmental damage.
The environmental requirements create the need to separation of oil vapors. The oil separation is created by a gradual separation in this case only a few quantity of oil are burned. The oil separation is realized in three steps:

- *rough oil separation*
- *fine oil separation*
- *air damping volume.*

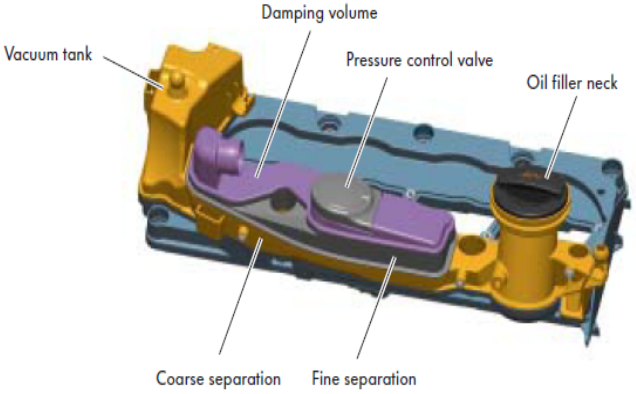

Figure 5. Crankes volume ventilation [7]

The rough oil separation are generated by oil collection volumes (Figure 6).

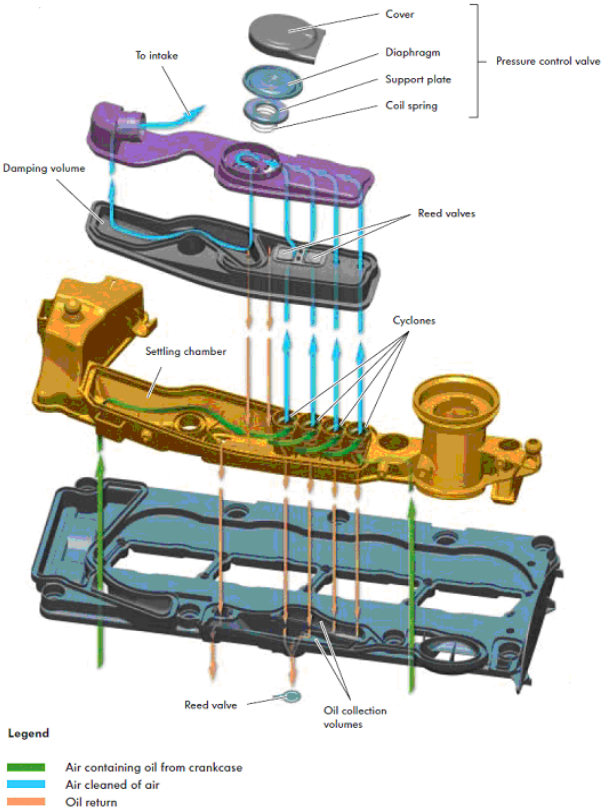

Figure 6. The rough oil separation [7]

The fine oil separaton are generated by four cyclones which are working function by the pressure level between volumes (Figure 7). Function of centrifugal forces the oil vapors are separated by cyclones.
For the engine ventilation it is necessary to control the blow-by gases pressure. The systems are composed by a diaphragm and pressure springs which are open or closed functions the blow-by gases pressure (Figure 8).

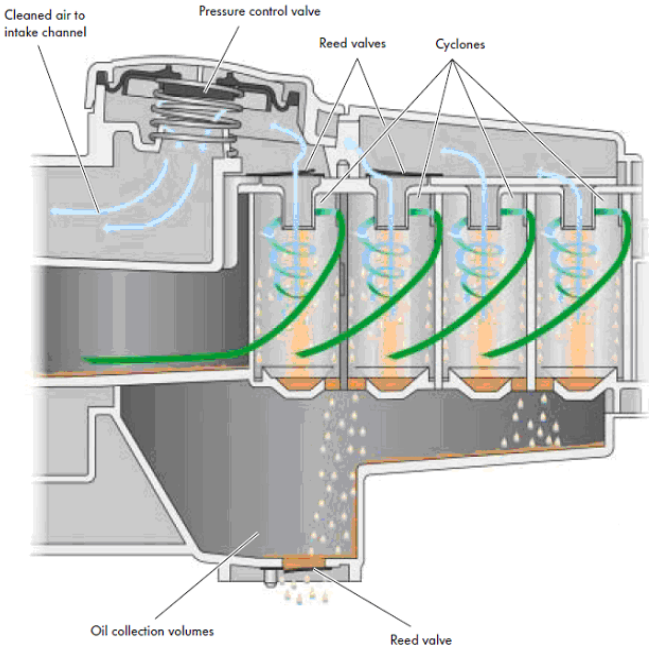

Figure 7. The fine oil separation [7]

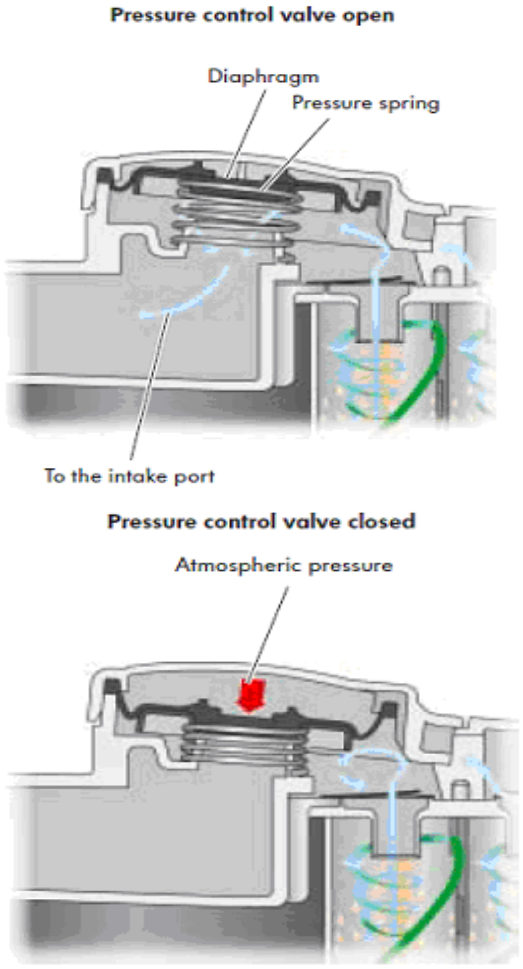

Figure 8. Pressure control valve [7]

To avoid the turbulent circulation of blow-by gases it is necessary to have a damping chamber, which reduces the kinetic energy of these gases and realized a small separation of oil (Figure 9).

These constructive changes must be together with other modifications which are for example: engine calibration, optimized fuel injection system, exhausted gases recirculation (EGR), cooled EGR, advanced turbocharger, intercooler, DPF.

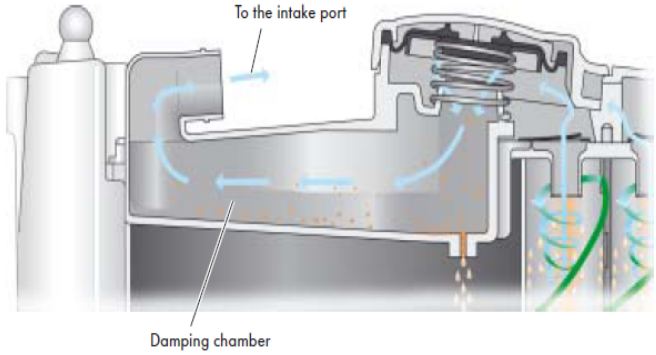

Figure 9. Damping chamber [7]

The optimum formula of constructive changes to fulfill Euro 5 or Euro 6 must be adjusted with vehicle mass and cylinder volume (Figure 10) to obtained a lower CO_2 emission.

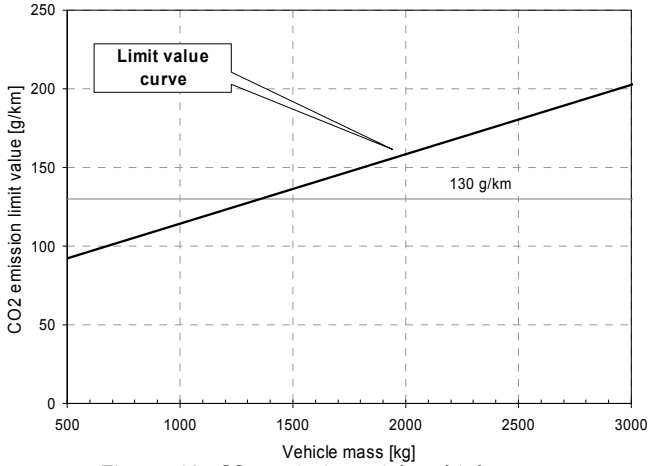

Figure 10. CO_2 emission with vehicle mass [Source: EU Commission]

Vehicle technical specification often evolves around regulation, and the cost impact is not immediately clear. The following example concerning the cost impact of the move towards Euro-IV compliance illustrates how complex the cost impact could be, and how dangerous it can be to generalise the cost impact of several possible technical solutions. All of the prices indicated are merely reflections of the relative cost of such systems, and depending on applications may vary; they also assume that all of these

CONCLUSIONS

By analyzing the accomplished researches regarding the constructive modifications from the diesel engine fulfill Euro 5 and Euro, results the following conclusions:

- *It is necessary to make constructive changes to pistons engine in correlation with optimization mixing air-fuel;*
- *The blow-by oil gases recirculation is important cu be controlled, because vapors of the oil which reach in to the combustion chambers increase the pollution degree;*
- *The blow-by oil gases are together with the wear of the sealing element;*

This constructive modification apply to diesel engine fulfill Euro5 and Euro 6 is just a part of the modifications, because to achieve this objectives is necessary to complete with a complex injection

system with a after treatment noxes systems, but every engine must be analyzed because there is not a general solution for every type of engine.

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