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# The effect of the working transitory regimes of the internal combustion engines with gas and liquid fuel supply upon the engine performance

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**Abstract.** The running of the Diesel marine engines under maximum safe conditions at the best economical and working parameters is one of the main requirements of a good navigation on the Seven Seas. This paper is proposed to present some essential aspects related to the internal combustion engines with gas and liquid fuels supply upon the working performance of the engine.

**INTRODUCTION**

The heat engines are systems which change the chemical energy into the mechanical work by evolution of a working fluid named motive fluid. The evolution of the motive fluid is performed by the driving mechanism and other auxiliary mechanisms being the piston heat engine unit. As any engine, inside of it, it is performed the change of a type of energy into the mechanical work. By performing the heat calculation of the engine is aiming at determining the state values of the motive fluid in its evolution as part of the duty cycle. This paper is intended to present some essential aspects related to the effects of the working transitory regimes of the internal combustion engines, supplied with different fuels, upon the engine performance. The working regime of a marine engine is described by the operating conditions pointed out by the mechanical power and economy indicators analyzed from the view point of mechanical and heat stress. Three main values define the working regime of an engine: the load, the crankshaft speed and the thermal condition of the unit. For qualitative and quantitative estimation of the working regime, it is used the following indicators: the economico-energetic (fuel consumption, power, speed, fuel-air mixture pressures, etc.) and the working indicators (pressures and temperatures of the working fluids). The deposits of hydrocarbons represent and inestimable richness and their use as fuel sources will be soon presented undoubtedly to some drastic restrictions. This because, on the one hand, they will be developed other means of power generation (atmospheric pollution without secondary effects, etc.) and, on the other hand, it is irrational to burn as far as the carbon dioxide and water of some compounds so valuable created by nature also from the carbon dioxide and water in a long and complex way.

**CHAPTER 1**

Why do we pass to (use) marsh gas ?

a. It reduces rapidly the costs

The gas offers significant financial economy for shipment using at present the black oil for supplying the main engines and the generators. The gas also offers a more bigger stability of the prices. The gas prices were historically less essential than the heavy fuel prices.

b. The environment protection

The natural gases are cleaner than the heavy fuel speaking about the emissions. Passing to the natural gases of the shipment will reduce the emissions of $CO_2$ to 25%.

Unlike the gas, the heavy fuel generates the sulfur dioxide and other significant pollutants in the combustion process contributing to the gas emissions with greenhouse effect. The sulfur dioxide generated by the black oil combustion can escape in air in the shape of fine particles. This represents a threat for the human being health, because they can get deeply to the lungs. These particles can also be carried at long distance and they can be finally deposited in the water systems causing (inducing) their acidifying.

c. Less maintenance time and costs.

The heavy fuel must be stored in tanks, unlike the gas which can be carried under safety conditions directly to the main engine or the steam generator. The storage (hopper) tanks of the heavy fuel must ~be kept in a warm place – in the same way as all the supplementary plants and the units related to the use of this fuel. With the natural gas, the companies can simplify the maintenance conditions due to the elimination (remove) of some units of the storage system.

**CHAPTER 2**

In this chapter, they will be presented the results obtained by the calculation process for determining the main working parameters of the engine using different fuels with different gravimetric participations, according to Table 1.

**Table 1.** Types of fuel and parameter.

| | Types of fuel | | | | |
|---|---|---|---|---|---|
| Parameter | C1 Diesel-marine | C2 Heavy fuel | C3 Black oil | C4 Gas oil | C5 Marsh gas |
| Low heating power | 39762 kJ/kg | 37142 kJ/kg | 38206 kj/kg | 42105 kJ/kg | 33500 kJ/kg |
| Carbon | 87% | 87,9% | 84% | 85,7% | 86% |
| Hydrogen | 12,4% | 7% | 11% | 13,3% | 13% |
| Sulphur | 0% | 3% | 3% | 0% | 0% |
| Oxygen | 0,6% | 0,6% | 1% | 1% | 1% |
| Water | 0% | 0,85% | 1% | 0% | 0% |
| Residues | 0% | 0,65% | 0% | 0% | 0% |

Due to the quality of the used fuel, they were considered lower or higher values of the use heat factors: Also, it was considered the initial value of the exhaust gas residue temperature different to each case.All the other initial calculation parameters were the same. All the results obtained are presented in table 2.

**CHAPTER 3**

The variation of parameters depending on the fuel of the engine

**Table 2.** The variation of efficiency.

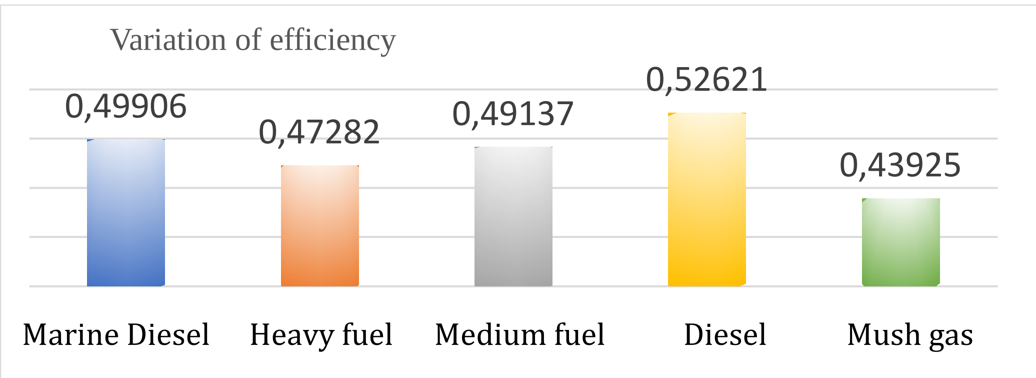



**Table 3**. The variation of effective efficiency.

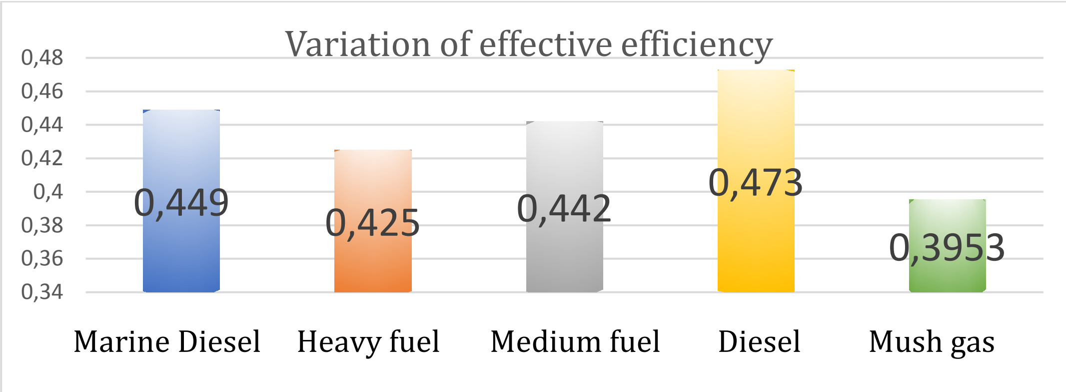



**Table 4** – The variation of fuel consumption, $c_e$;

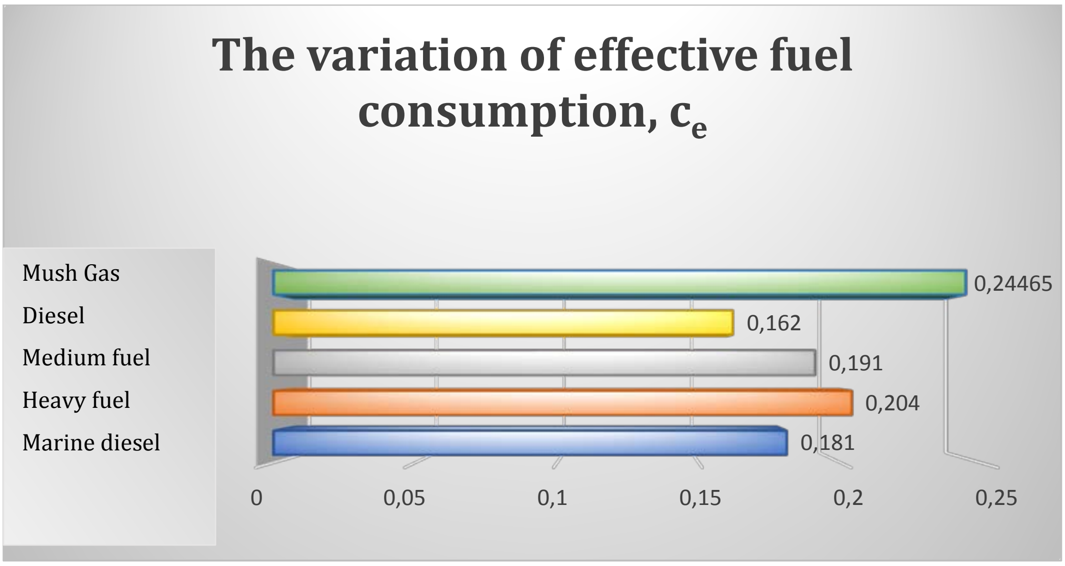



**Table 5**. The variation of effective fuel consumption, $c_e$;

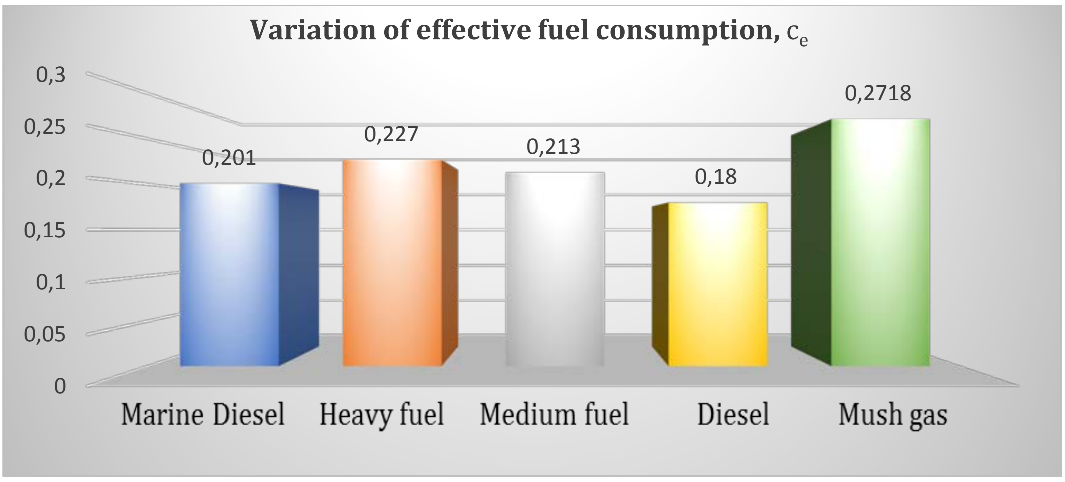



**Table 7**. – The variation of the work, Li;

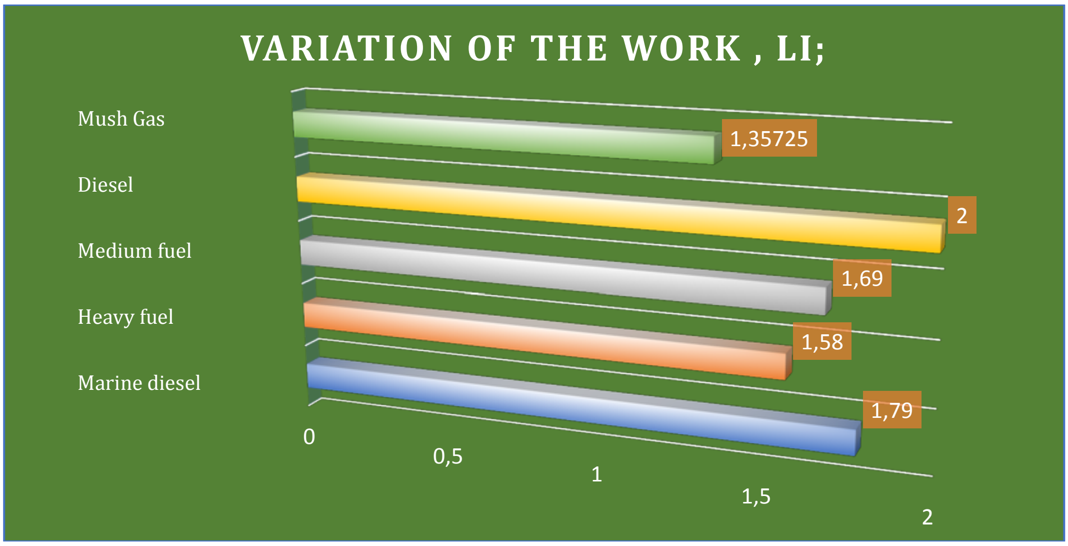



**Table 8.**– The variation of the motive fluid energy sat the end of the isochoric combustion.

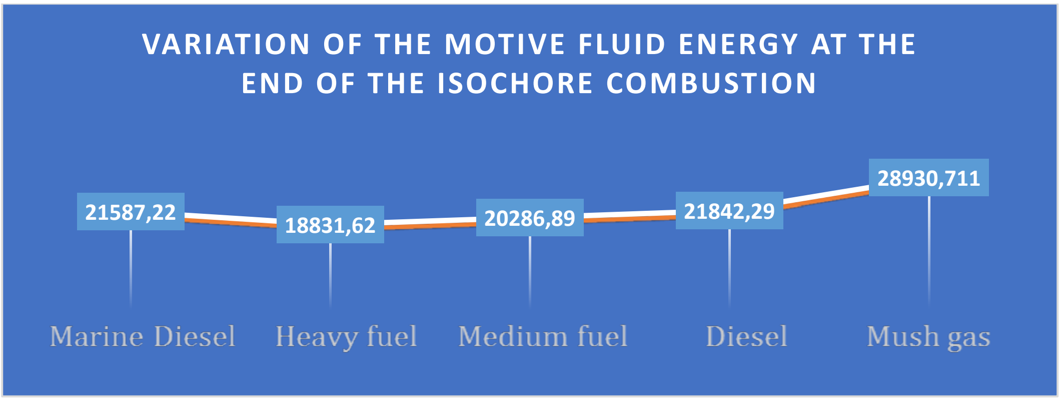



**Table 9**. – The variation of $CO_2$ quantity.

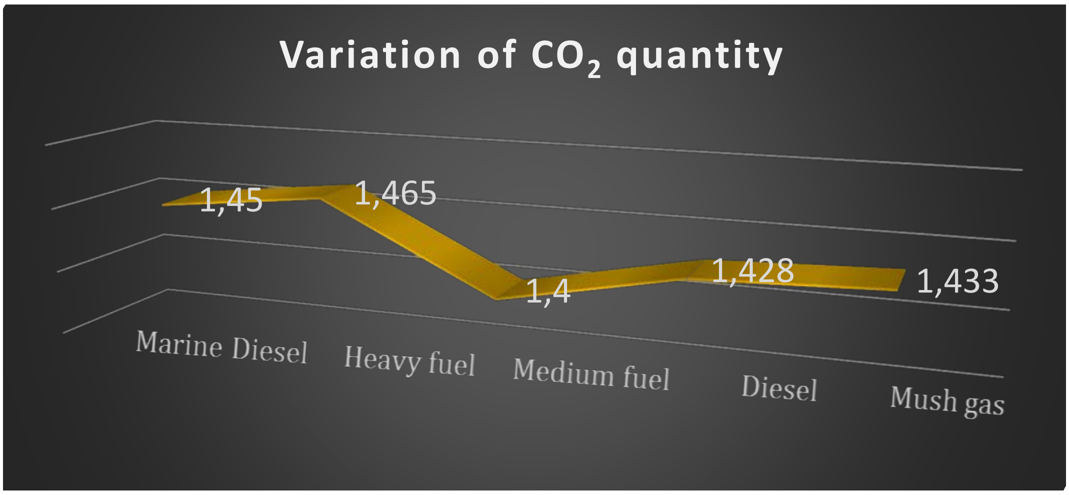
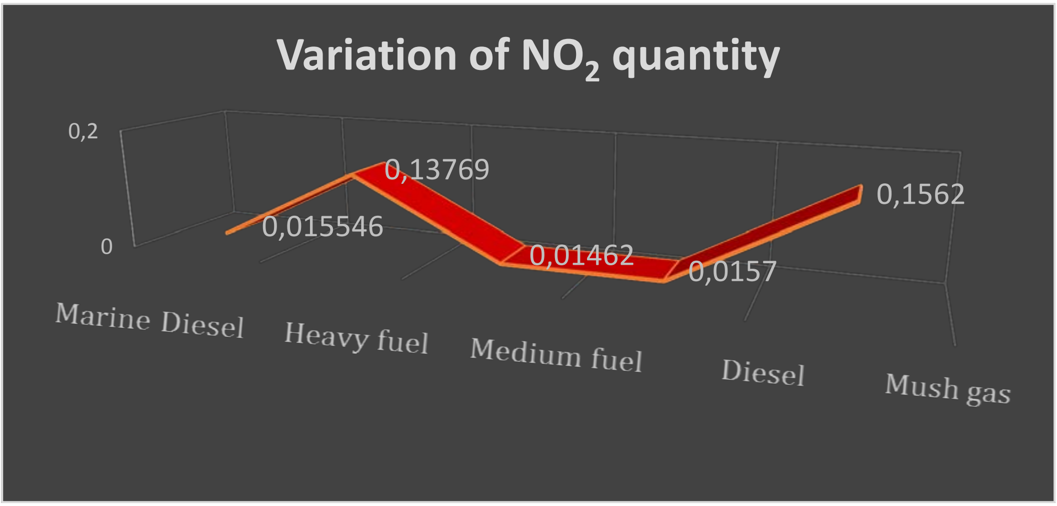



**Table 10.** – The variation of $NO_2$ quantity.




**CONCLUSIONS**

The use of the marsh gas instead of the heavy fuel has profitable effects regarding the environment protection due to the substantial reduction of $CO_2$ and $CO$ emissions, and less of the nitrogen oxide emissions. Its use helps on economy of ship building price by simplifying the plants for the fuel preparation and reduce a small part of engine power.

| Title | **The effect of the working transitory regimes of the internal combustion engines with gas and liquid fuel supply upon the engine performanc** |
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