

EXPERIMENTAL STUDY OF THE ENGINE WITH ADDITIONAL AIR ON NATURAL GAZ FUEL IN “COBOLT”

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Abstract. This article presents the prospects for the use of natural gas for automobile engines, which can be expressed, first of all, in terms of environmental friendliness, the abundance of raw materials in our country and the unique performance of the engine.

Key words: car engines, natural gas fuel, additional air, gas cylinder

Аннотация: В данной статье рассматриваются перспективы использования природного газа в автомобильных двигателях, которые, прежде всего, обусловлены его экологичностью, обилием сырья в нашей стране и уникальными эксплуатационными характеристиками.

Ключевые слова: автомобильные двигатели, газовое топливо, дополнительный воздух, газовый баллон.

Currently the rapid reduction of organic fuel reserves and the continuous growth of the human need for energy consumption, which leads to environmental pollution, creates a situation characterized by energy-ecological degradation. For this reason, large-scale research is being conducted to solve the problems of reducing the consumption of non-renewable energy sources and the pollution of the environment with toxic waste. The most developed countries have stricter requirements for the ecology of waste gases. Thus, in the last 10 years, the European Economic Community has made rapid progress in the field of reducing car engine emissions. Euro-1 standards have been accepted in Europe in 1993.

Euro-2 standards in 1997, Euro-3 standards in 2001, Euro-4 standards in 2006. Euro-5 standards and Euro-6 standards are being harmonized for implementation from 2011 and 2015, respectively. [1]

Currently, the main types of fuel used for car engines are studied by many authors, including foreign scientists Erokhov V.I. [8], Khachiyan A.S., Chernyshova N.D., John Stepherson and Uzbek scientists A.Mutalibov, N.Mannonov, B.I.Bazarov, S.M.Kadyrov, M.M.Orifdjonov et al.

TABLE 1. List of measurements to be performed

№	The name of the quantity to be measured	Unit of measurement	Marker	Recommended accessories		
				Name	Accuracy class	Measurement limit
1	Gas pressure in cylinder(s) before test	kgs/cm ² (MPa)	R ₁	Exemplary pressure gauge GOST 6521	1.0	0-250 (0-25.0)
2	Pressure in cylinder(s) at end of test	kgs/cm ² (MPa)	R ₂	Exemplary pressure gauge GOST 6521	1.0	0-250 (0-25.0)
3	Gas temperature (ambient air)	°C	t ₂	Thermometer with meteorological glass GOST 112	1.0	-100 +100
4	Test time	s	t	Stopwatch GOST 5072	0.5	—
5	Distance of the vehicle during the test	km	S	Speedometer GOST 12936 (ST SEV 48657)	0.5	—

Note: Tests should be conducted in the following natural conditions: [6]

- the wind speed does not exceed 3 m/s;
- when there is no rain;
- air temperature from -5 to +25°C;

-atmospheric pressure 730-770 mm.sim. top;

-air humidity -90%.

1. The method of measuring the amount of gas consumed during the experiment consists in determining the change in gas pressure in the cylinder and the temperature of the gas (ambient air) at the beginning and end of the test, setting the appropriate gas compression factors.

2. The amount of gas consumed during the test is determined by the formula here,

$\sum V_b$ – total volume of the cylinder, m^3 ;

R_1 va R_2 – pressure of the gas in the cylinder at the beginning and end of the test, kgs/cm^2 (MPa);

z_1 va z_2 – compression coefficient at the start and end of the test.

$$\sum V_b = V_b * \frac{n}{1000}, \quad m^2(1)$$

Here

V_b – volume of one cylinder, l;

n – number of cylinders.

Gas compressibility factors are functions of gas temperature and pressure determined by a nomogram. [7]

Example: testing the Cobolt car with a gas cylinder, $V_b=100$ l, we get

$R_1=18,5$ MPa, $R_2=16,8$ MPa, $t_2=14$ °C, $z_1=0,83$; $z_2=0,825$,

Then

$$\sum V_b = 100/1000 = 0,1m^3(2)$$

$$Q_{yo} = 10 \cdot 0,1 \left(\frac{18,5}{0,83} - \frac{16,8}{0,825} \right) = 1.93 m^3(3)$$

Figure 3. Nomogram for calculating the volume of gas consumed

By determining Q_g , knowing the mileage S of the car and the useful work done W , we can calculate the mileage or gas consumption of the vehicle:

$$Q_n = 100 \cdot \frac{Q_g}{S}, \quad m^3/100 \text{ km} \quad (4)$$

$$Q_m = 100 \cdot \frac{Q_g}{W}, \quad m^3/mkm \quad (5)$$

if, Q_g – gas consumption, m^3 ;

S – the distance traveled by the car km ;

W – useful work ratio, $t \times km$.

TABLE 2. Processed results of the experiment for the Cobolt car in the route
“Bakhmal – Jizzakh – Bakhmal”

№	Mean value of fuel consumption		Deviation from the average value $x_i - \bar{x}$	$(x_i - \bar{x})^2$
	In natural gas	When adding additional air to natural gas		
1	10,70	9,95	0,249	0,062001
2	10,37	9.89	-0,071	0,005041
3	10,56	9.92	0,099	0,009801
4	10,75	10.02	0,299	0,089401
5	10,36	9.88	-0,091	0,008281
6	10,70	9.92	0,249	0,062001
7	10,52	9.89	0,059	0,003481

In natural gas $\bar{x} = 104,51 : 10 = 10,45 \text{ m}^3/100 \text{ km}$

When adding additional air to natural gas $\dot{x} = 98,94 : 10 = 9,894 \text{ m}^3/100 \text{ km}$

Deviation from the average value:

$$\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}} = \sqrt{\frac{0,50849}{10}} = \sqrt{0,050849} = 0,23 \text{ m}^3/100 \text{ km} \quad (6)$$

In natural gas

$$l_n = 10,451 - 0,04 = 10,291 \text{ m}^3/100 \text{ km}$$

$$l_v = 10,451 + 0,16 = 10,611 \text{ m}^3/100 \text{ km}$$

When adding additional air to natural gas $\dot{x} = 98,94 : 10 = 9,894 \text{ m}^3/100 \text{ km}$

$$l_n = 9,894 - 0,04 = 9,854 \text{ m}^3/100 \text{ km}$$

$$l_v = 9,894 + 0,16 = 10,054 \text{ m}^3/100 \text{ km}$$

Thus, the mean value of 10.451 is very close to the commonly seen mathematical representation, i.e. the obtained estimate is between $M(Q) = 10.451$

(10.291; 10.611) for natural gas and $M(Q)=9.894$ (9.854; 10.054) for natural gas with additional air. $P=0.95$ for reliability can be confirmed that the deviation of the actual fuel consumption from the actual value is equal to 0.16.

Conclusions. As a result of the work carried out, the following were determined: 1. Standard fuel consumption of natural gas per kilometer for Cobolt car is $10.45 \text{ m}^3/100 \text{ km}$ and $9.894 \text{ m}^3/100 \text{ km}$ when adding additional air to natural gas, i.e. 5.32% of fuel;

2. The obtained normative values of natural gas consumption allow the "Uzbekistan Refractory and Heat-Resistant Metals Plant" to implement organizational and production measures and introduce a fuel economy promotion system;

3. The term of applying winter and summer surcharges to fuel consumption norms is determined by the order of the organization in accordance with UzRh 8.20-01:2003;

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