GDAŃSK UNIVERSITY OF TECHNOLOGY

Journal of POLISH CIMAC

Faculty of Ocean Engineering & Ship Technology
GDAŃSK UNIVERSITY OF TECHNOLOGY

MEASUREMENT OF AUTOMOTIVE VEHICLES POWER IN REAL ROAD CONDITIONS

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Abstract

A portable engine test bench makes it possible to measure power and torque, acceleration of given speed, breaking distance, and distortions of the speedometer reading. The operation principle of a portable test bench is similar to that of a stationary load test bench with the only difference that the vehicle testing takes place in real road conditions, not in simulated ones, on the rollers of a stationary engine test bench.

In this work, the operation principle of the portable engine test bench, the measurement method and exemplary results that have been obtained from carried out experimental test have been presented which provides the basis for further measurements of the vehicle operation real parameters in real not laboratory conditions.

Keywords: *measurement of engine power, portable engine test bench*

1. Introduction

In their service instructions, car producers provide some engine parameters. This information is of great significance for the user, especially for the potential buyer of a given vehicle. From this data customers can draw fargoing conclusions.

These parameters include:

- engine capacity
- torque
- power

As it is commonly known, the engine power means work of pressure of gases acting on the piston bottom, performed in a time unit. For multi cylinder engines it is the sum of the power of cylinders that make up the power unit.

The driver is interested in useful power. This is power which can be transmitted to a receiver in any conditions of the engine operation [1, 3].

Rated power of an engine is guaranteed by the producer of the power unit for given conditions of operation. For passenger car engines the rated power equals maximal power, i.e. such that the engine can provide under constant load over a given time without the fear of exceeding mechanical allowable load or overheating. The maximal value of power is given in most of service instructions and technical data specifications for passenger cars. Both power and torque are variable in the function of the engine rotational speed.

A portable engine test bench makes it possible to measure power and torque, acceleration of any speed, breaking distance and distortions of the speedometer reading. The operation principle of the engine test bench is similar to a stationary load engine test bench with the difference that the measurement is performed in real conditions on the road not in conditions simulated on rollers.

A portable engine test bench has many advantages [2]:

- accuracy – with the assumption that the parameters are appropriate, measurement error is smaller than 1%.
- the car is tested in its natural conditions, on the road – there is no problem with improper air supply, which makes the measurement accuracy higher than in a test house on a chassis test bench,
- frequency of drawing data onto a chart: 60 times per a wheel revolution. Power and torque is provided with accuracy up to 0.1 KM and 0.1Nm. and the revolutions for which these parameters are obtained with accuracy of 1 revolution. .
- program for control of the engine test bench enables manual entering of transmission values – it allows to eliminate errors which occur due to wrong calculations by programs for control of engine test bench transmissions.
- program for control of the engine test bench has many interesting functions: ability ot compare up to 4 charts simultaneously, clear results in the form of tables and charts, full control of printouts etc.
- correction of measurements according to DIN70020 ensures that neither the air temperature nor pressure affects fluctuations of power measurements.
- there is a possibility to test a car with four wheel drive.

Fig. 1. Image of portable engine test bench

2. Operation principle of portable engine test bench

Like in a load engine test bench: the car, being in a given gear, is accelerated within an established range, then it is switched into the neutral and the rolling resistance is measured- with the difference that the sensor reading 60 impulses per one wheel revolution is fixed on the car, not at the rollers of a stationary test bench.

Due to such an operation principle the device is characterized by high accuracy. For the purpose of high measurement accuracy it is necessary to be familiar with the vehicle weight, gear box ratio (it can be determined on the road), size of tires. It is also necessary to enter the air temperature and atmospheric pressure to make the given result recalculated with DIN norm obligatory in Europe.

Since changes of atmospheric pressure, air humidity or its temperature affect the measured values – they are normalized and the obtained measurement results are converted into values corrected with normal parameters (according to DIN 70020 – 25C°and 1000 HPa (does not account for humidity) and a special correction factor –power is estimated to change by 1% for temperature change by 5-6 degrees) engines tested according to American norm SAE do not have some accessories: air filter, alternator/ generator, fuel pump, clutch, radiator fan and exhaust system – therefore, the results according to SAE norm are higher by nearly 15-20 %.

3. Description of the experiment

The tests were performed with the use of Honda Accord VI from 2000 with engine 1.8 16V (136KM). Preparation for tests involved screwing a measuring disc and its revolution sensors to the vehicle wheel, connection of a cable for reading of the ignition system impulses (fig. 2)- measurement is performed in normal riding conditions and the results are transmitted to a portable computer which shows particular results of measurements.(fig. 3).

In order to achieve proper results, such data as temperature, air pressure, size of tires, ratio of the power transmission system – were given.

Fig.2. Manner of fixing a measurement disc with the sensor

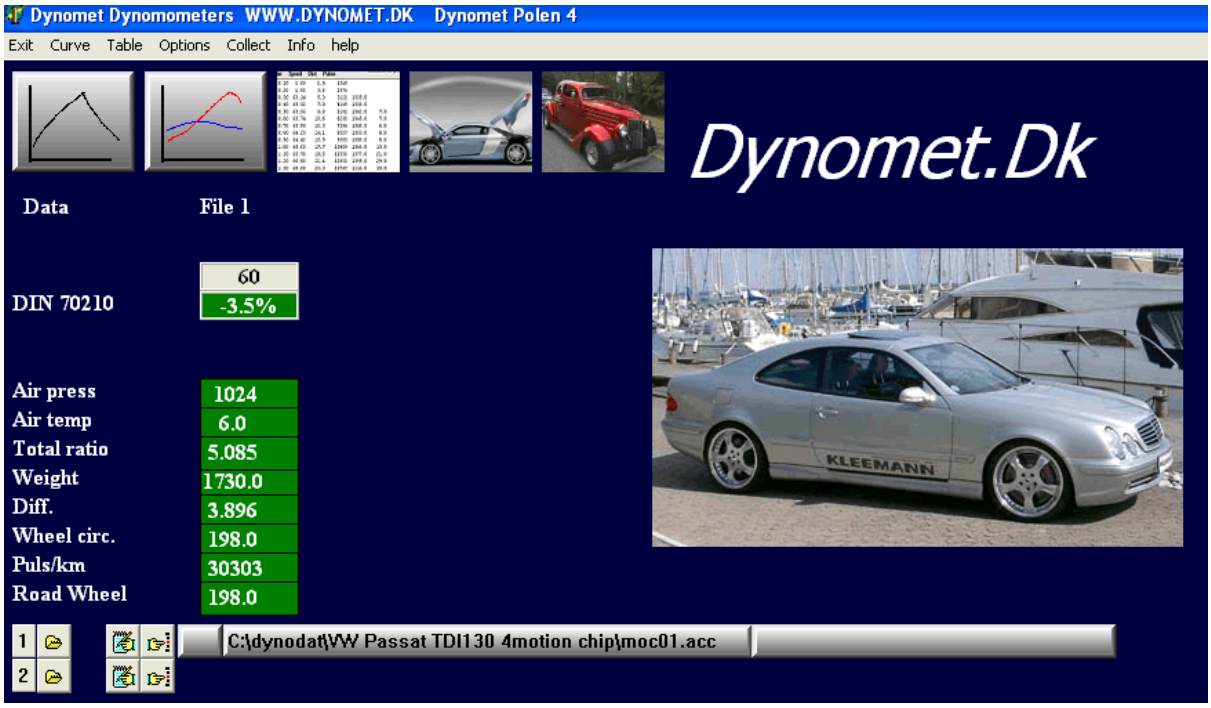

Fig. 3. Image of Dynomet dk program window

The measurements have proved that (fig.4) although the vehicle is 12 years old its power in real conditions does not differ from the power indicated by the producer.

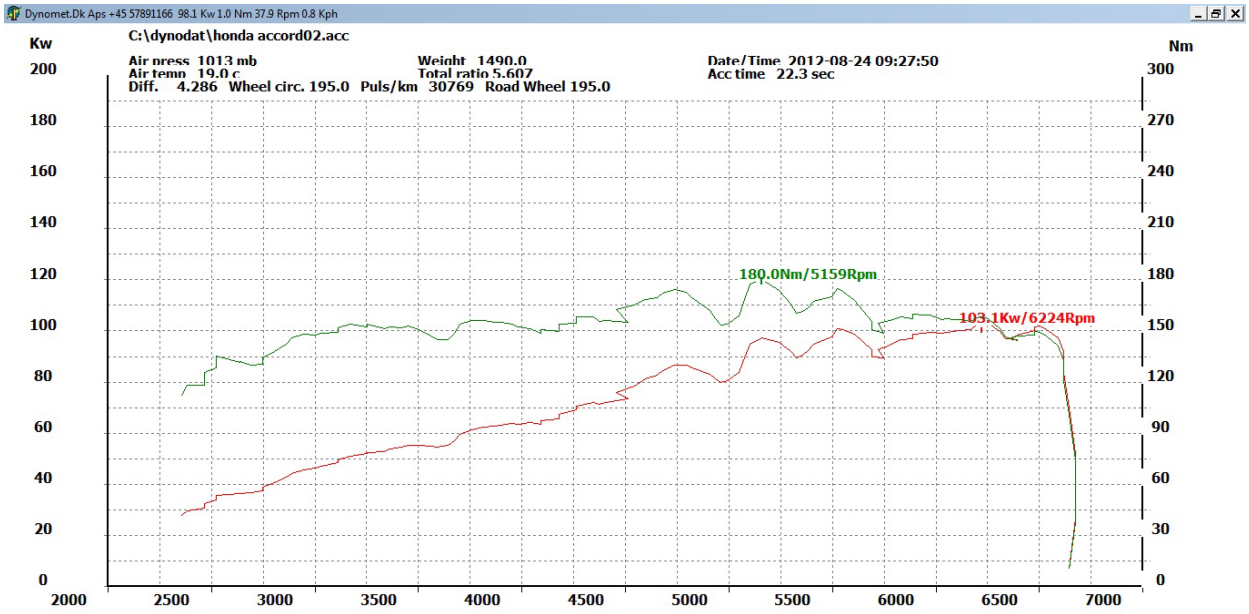

Fig. 4. Exemplary chart from the tested vehicle power measurement

During testing it was possible to observe the vehicle actual speed (fig.5)

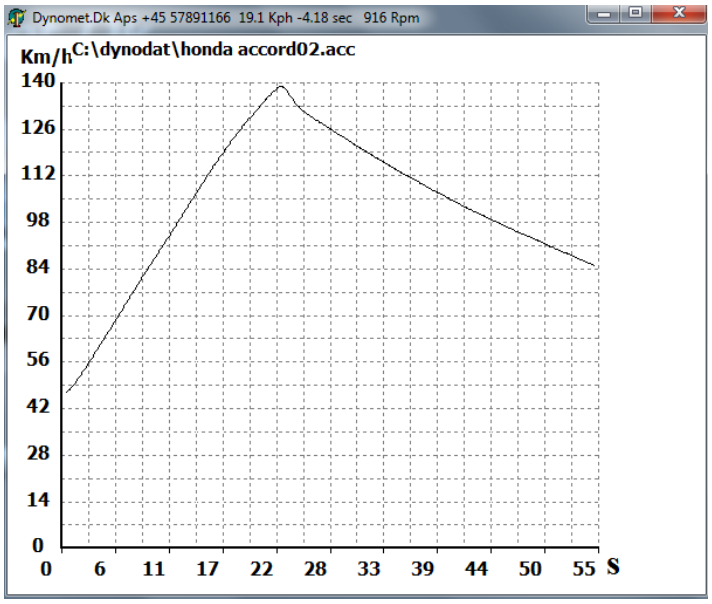

Fig. 5. Chart of speed shows how the vehicle actual speed changes in te function of time.

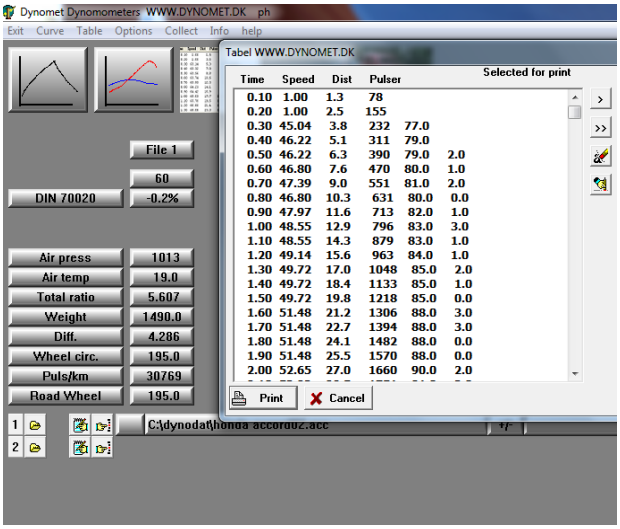

Fig. 6. Measurement table

In the above presented table 3 the first columns are: Time = (s) – Speed (km/h) and Distance Dist – distance covered (m).

5 Summary

A device of this type can provide data on the car acceleration, its elasticity in particular gears within assigned values, power and torque in the function the engine revolutions and even the braking force. Accuracy of the power measurement on the wheels is increased by the value of air resistance – significant for high speeds, and it allows to establish what actual power is actually available and what is the maximal power that can be reached by the vehicle [4]. Undoubtedly, a disadvantage of such a device is approximate power of the engine (calculated by means of special algorithms which are designed to calculate approximate value of losses in the power transmission system). Moreover, when there is a sensor fixed on the wheel the measurement must be performed precisely along a straight line so that the wheel will not travel a distance different than the one that has been assumed.

This study aimed to carry out a preliminary measurement verification test, the development of reliable methods for measuring and obtaining data for further verification.

While further research should be carried out verification of the above mentioned studies and research carried out by stationary dynamometer. Only the results of these studies will help to understand the real differences arising from the use of the vehicle in real time.

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The work was carried out under the project „**Techniki wirtualne w badaniach stanu, zagrożeń bezpieczeństwa i środowiska eksploatowanych maszyn”**.
Project number: **WND-POIG.01.03.01-00-212/09**