ASPECTS OF VOLUMETRIC EFFICIENCY MEASUREMENT FOR RECIPROCATING ENGINES

by

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The volumetric efficiency significantly influences engine output. Both design and dimensions of an intake and exhaust system have large impact on volumetric efficiency. Experimental equipment for measuring of airflow through the engine, which is placed in the intake system, may affect the results of measurements and distort the real picture of the impact of individual structural factors. This paper deals with the problems of experimental determination of intake airflow using orifice plates and the influence of orifice plate diameter on the results of the measurements. The problems of airflow measurements through a multi-process Otto/Diesel engine were analyzed. An original method for determining volumetric efficiency was developed based on in-cylinder pressure measurement during motored operation, and appropriate calibration of the experimental procedure was performed. Good correlation between the results of application of the original method for determination of volumetric efficiency and the results of theoretical model used in research of influence of the intake pipe length on volumetric efficiency was determined.

Key words: *internal combustion engine, flow measurement, power, volumetric flow rate, volumetric efficiency*

Introduction

Output engine parameters like power, torque, fuel consumption, *etc*. essentially depend on characters of processes that develop during exhaust and intake strokes. Design conception and dimensions of intake-exhaust engine system have a large influence over the flow processes in pipes and characters of both exhaust and intake processes development. Thus, in serial intake systems, up to 10% larger torque may be obtained by its optimization [1-3]. This fact is known from the early days of engines. Scientists have engaged in investigations of flow phenomena in intake-exhaust system since 1927, when Capetti [4] established a simple resonant wave action theory. The first calculations were based on determination of geometrical parameters of the intake system in order to achieve dynamical effects in pipelines at certain engine speeds [4]. In all these calculations, contribution to increase of volumetric efficiency could be determined only by experiment [5, 6].

With development of computer techniques, possibilities for using complex 1-D, 2-D or multi-dimensional models occurred, based on which, a number of programs for calculation of gas exchange process in engines, like PROMO-4 1-D and FIRE (3-D) were developed. These

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