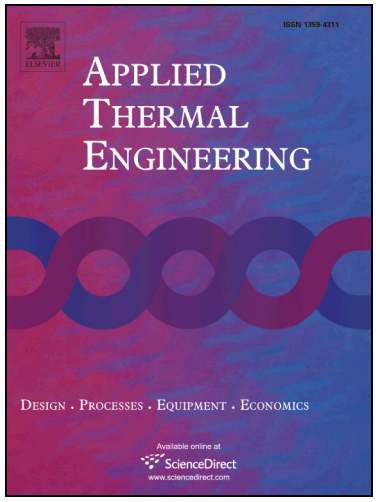

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PII: S1359-4311(16)30407-0
DOI: http://dx.doi.org/10.1016/j.applthermaleng.2016.03.103
Reference: ATE 7971

To appear in: *Applied Thermal Engineering*

Received Date: 4 November 2015
Accepted Date: 17 March 2016

Please cite this article as: K. Alhussan, M. Assad, O. Penazkov, Analysis of the actual thermodynamic cycle of the detonation engine, *Applied Thermal Engineering* (2016), doi: http://dx.doi.org/10.1016/j.applthermaleng.2016.03.103

Analysis of the actual thermodynamic cycle of the detonation engine

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ABSTRACT

Two variants of the limitations are analysed: in the first case the cycles are compared at the same degree of adiabatic compression, in the second – within the same interval of limiting temperatures. The values of the thermal efficiency and pressure intervals are compared, as well as the introduced additional criteria for assessing the thermodynamic perfection: the specific volume work, the criterion of irreversibility, and the nondimensional value Z, characterizing the fraction of the effective work from the mechanical work obtained per cycle.

The analysis carried out has revealed that a detonation engine possesses an advantage over some parameters, especially over the thermal efficiency, but its superiority is not absolute.

Keywords: thermodynamic efficiency, detonation, temperature, pressure, thermodynamic cycle, limiting parameters, working process, irreversibility criterion, nondimensional criterion.

1. Introduction

The most important criterion of the efficiency of the heat engine is the degree of the thermodynamic perfection of its operating cycle. The thermodynamic cycle of the detonation engine is basically similar to the cycles of other heat engines in terms of the structure of the elementary processes composing its diagram. There is no doubt, however, that it has some unique features related in the first place to heat supply to the working body, which distinguishes it from other well-known thermodynamic cycles.

The thermodynamic cycle of the detonative combustion is studied in many works, for example, [1–14] that all center on an attempt to demonstrate its efficiency by comparing with the certain cycles of the existing jet engines. To determine the parameters of the detonation process (temperature, pressure, Mach