ICE WITH A NON-CONVENTIONAL COOLING SYSTEM TEMPERATURE MAPPING

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Abstract

Within the framework of the basic research task funded by the Agency for support of research and development we solve a problem of a more effective non-conventional usage of the part of energy taken away by the ICE cooling system. The energy is used for production of cold. Results of partial solutions and methodology of energetic evaluation have been already presented in various conferences and symposia as well as published in several professional journals. This contribution brings some newly acquired theoretical and practical experience gathered during the operation of a test laboratory sample of the cooling engine in a non-conventional energetic unit. Experiments were focused on temperature mapping. The basic scheme of a non-conventional energetic unit with a cooling engine, the view of a functional laboratory sample, surface temperature in the vicinity of evaporator – taken by thermal imaging, time course of changes in the engine torque, revolutions and temperature on the engine, temperatures in the evaporator, temperatures in the liquefier, temperatures in the absorber, temperatures in the evaporator, temperatures in the VBR exchanger are presented in the paper. The results of the experiment shown that there is a 10 – 15 % agreement with the results acquired through calculations. Theoretical assumptions and solutions carried out for the alternative cooling liquid of the cooling engine in a non-conventional energetic unit can be considered real. Within the framework of this consideration a test circuit is being prepared for experiments with alternative cooler.

Keywords: *non-conventional cooling system, combustion engine, non-conventional energetic system, thermal balance*

1. Introduction

The aim of using energy contained in fuel in a more effective way together with the aim of reducing negative impact of "waste heat" produced by a combustion engine on the environment have led to the use of cogeneration and three-generation equipment. Within the framework of the basic research task funded by the Agency for support of research and development we have been solving the problem of a more efficient non-conventional usage of the part of energy taken away by the combustion engine cooling system for the production of cold. This type of combustion engine is simply referred to as the cooling engine. The substance of solution and methodology of energetic evaluation have been presented in various symposia (KONES, KONMOT, ...) and conferences (Science and motor vehicles, KOKA, ...) and also published in scientific and professional journals. This contribution brings some newly acquired theoretical and practical experience gathered from the operation of the test laboratory sample of the cooling engine in a non-conventional energetic unit. The experiments focused on temperature mapping. The basic scheme of the non-conventional energetic unit with a cooling combustion engine is illustrated in Figure 1. The actual sample can be seen in Figure 2.

2. Experiment

For the purpose of further analysis and verification of spreading and distribution of temperatures not only in parts of the cooling engine but also in all the non-conventional energetic

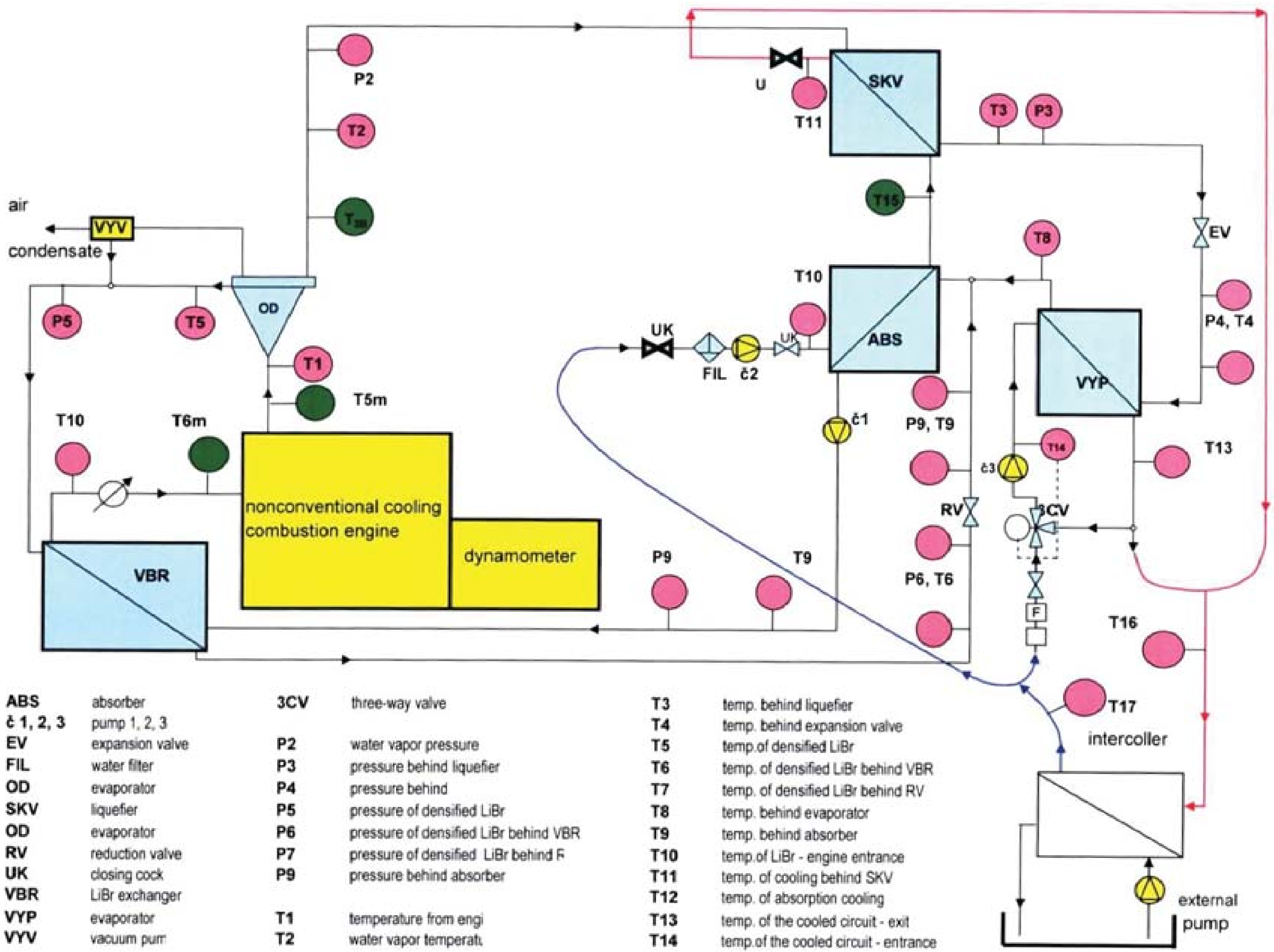

Fig. 1. Basic scheme TEXT energetic unit with cooling engine

system some comparative measurements on the laboratory sample were carried out under the following conditions:

Fig. 2. A view of a functional laboratory sample

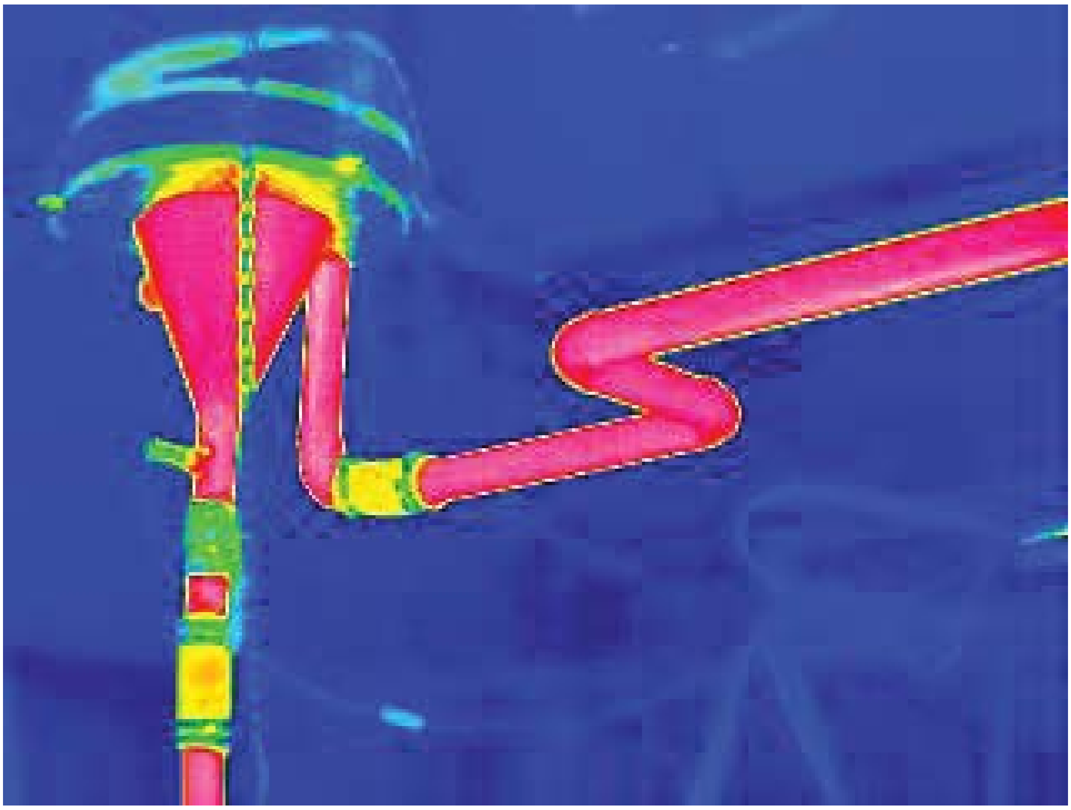

Fig. 3. Surface temperature in the vicinity of evaporator – taken by thermal imaging

- the whole system was filled with the original cooling liquid,
- the sampling frequency was 2 Hz,
- the fixed testing regime of the engine in the interval of 650 – 5 800 s,
- the specific engine output in the interval of 5 900 – 6 100 s,
- the maximum engine torque in the interval of 6 180 – 6 270 s,
- the engine idle run in the interval of 6 300 – 6 630 s,
- the stopping of engine in 6 650 s,
- the system inertia observed in the interval of 6 650 – 12 000 s.

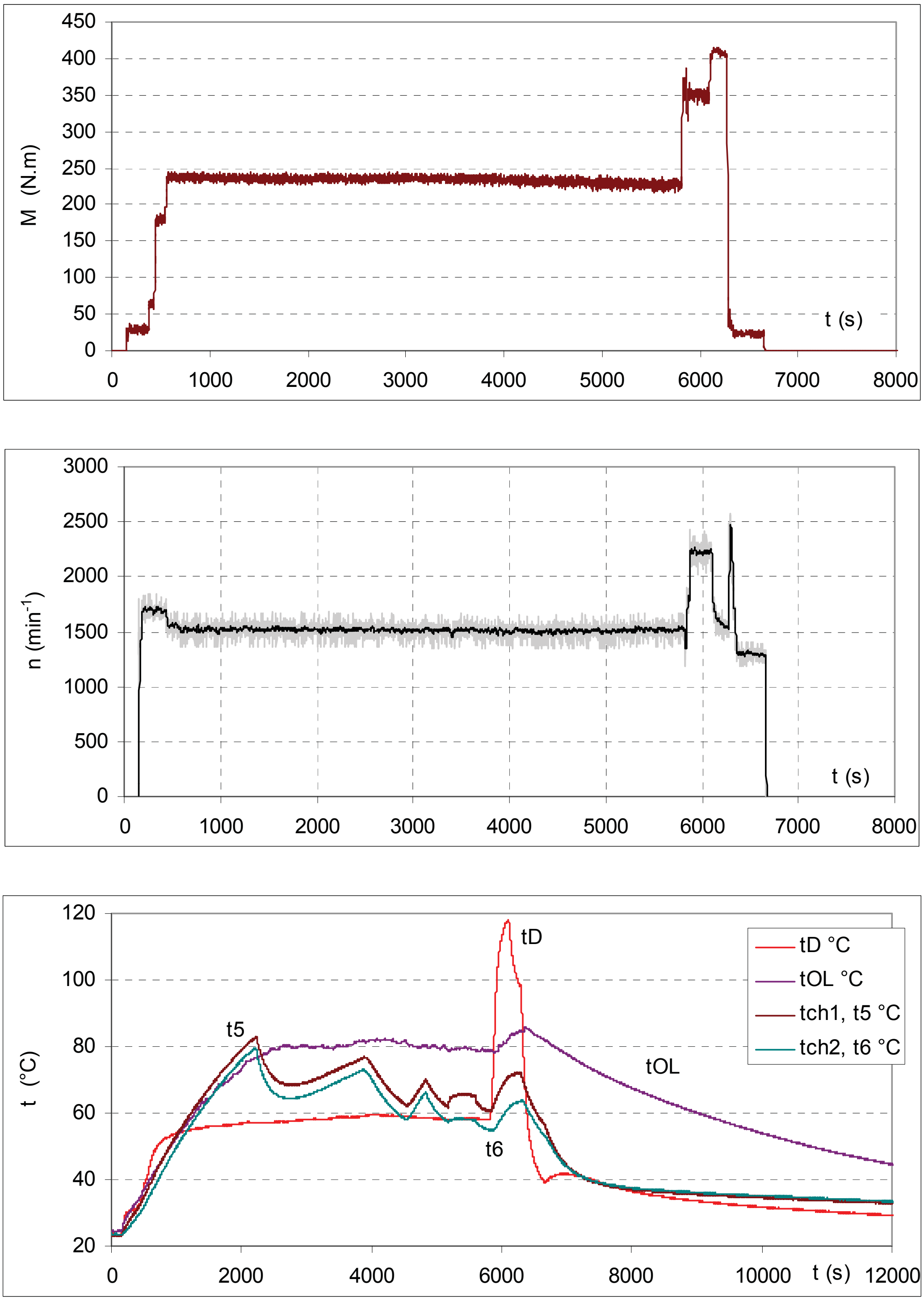

Fig. 4. Time course of changes in the engine torque, revolutions and temperature on the engine

Temperatures were taken by means of thermocouples. Their location can be seen in the scheme – Figure 1.

The surface temperature of individual parts of the non-conventional energetic unit with a cooling engine can be identified from records of thermal imaging. Figure 3 can serve as an example.

Figure 4 presents the first part of the test schedule – time course of the change in revolutions and engine torque. After the engine stopped, thermal inertia of the system was recorded.

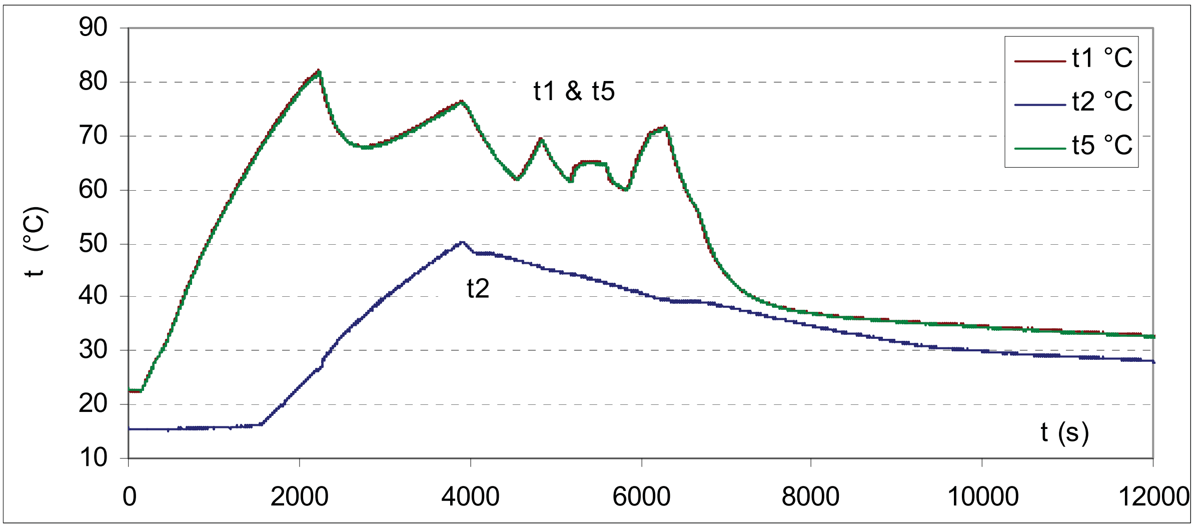

Fig. 5. Temperatures in the evaporator

3. Results of the experiment

As we have already mentioned, the aim of the experiment was to verify theoretical solutions and assumptions already published.

Figures 5, 6, 7, 8 and 9 illustrate some courses of changes in temperature during the experiment in predetermined places of interest.

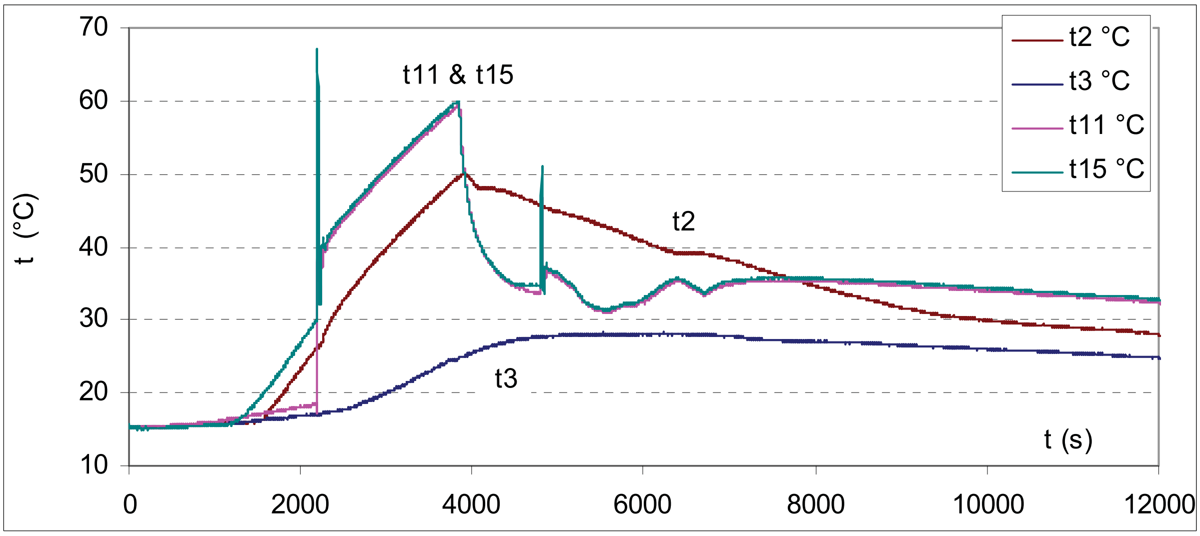

Fig. 6. Temperatures in the liquefier

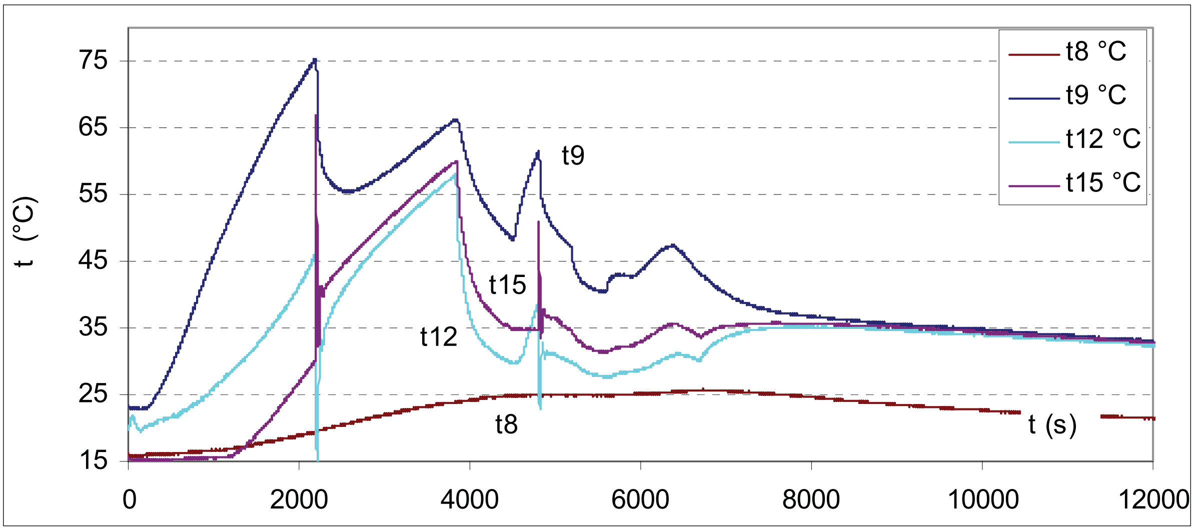

Fig. 7. Temperatures in the absorber

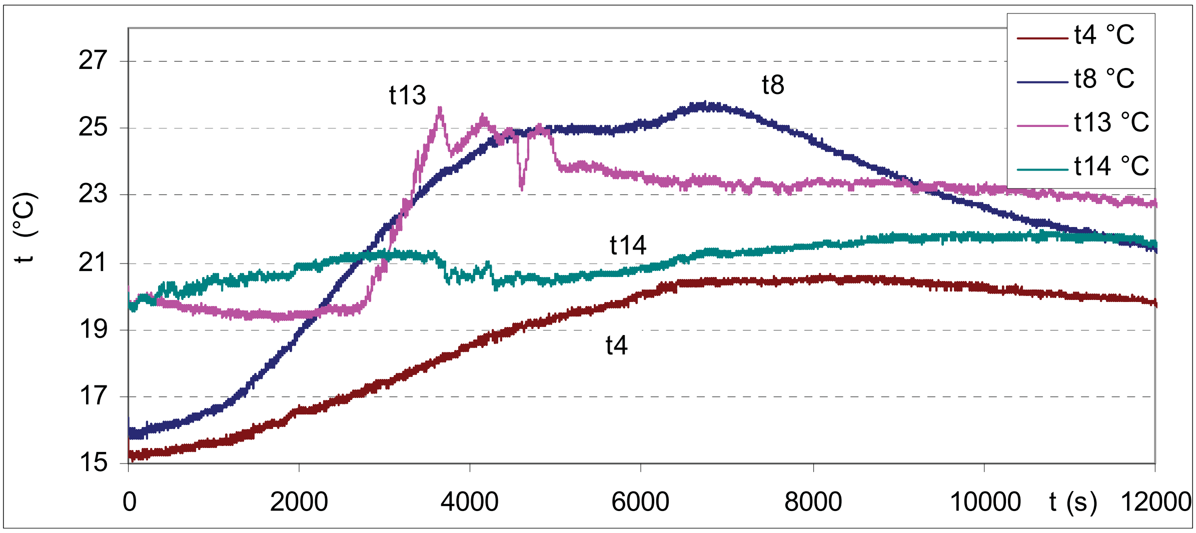

Fig. 8. Temperatures in the evaporator

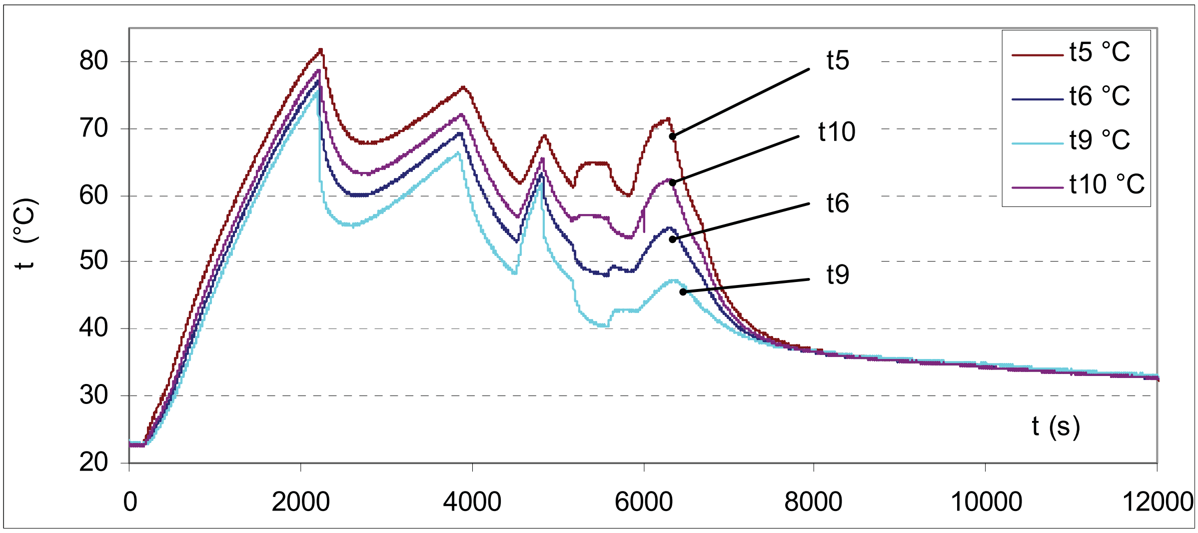

Fig. 9. Temperatures in the VBR exchanger

4. Conclusion

The results of the experiment show that there is 10 – 15 % agreement with the results acquired through calculations. Based of the result we can say that theoretical assumptions and solutions carried out for the alternative cooling liquid of the cooling engine in a non-conventional energetic unit can be considered real. Within the framework of this consideration a test circuit is being prepared for experiments with alternative cooler.

With reference to the analyses we can conclude that the reconstruction of the original cooling system into a non-conventional with alternative cooler is accompanied with the fact that the values of thermal flows are in direct relation with mass flows past individual cylinders.

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