



PhD Thesis Review

PhD candidate: **Ing. Tomáš Fečer**
Title: **Heat transfer analysis of phase-change process in tubular exchanger**
Supervisor : **Ing. Josef Plášek, Ph.D.**
Reviewer : **prof. Ing. Karel Kabele, CSc.**

This report was prepared based on dissertation by Ing. Ing. Tomáš Fečer with title Heat transfer analysis of phase-change process in tubular exchanger, delivered to me in February 202e. The presented work has 101 pages.

1. RELEVANCE OF THE CHOSEN TOPIC

The topic of the dissertation develops an area researched since the end of the 18th century and is focused on the study of physical phenomena related to phase changes in modern heat exchanger designs. Due to the ongoing development of these heat exchangers, this topic is considered timely and necessary for the further development of knowledge.

2. FULFILMENT OF WORK OBJECTIVES

Two research objectives are set in the thesis, aimed at developing the understanding of the physical phenomena of phase transformation of liquid and gas phases. The first is in the field of water vapour condensation in a tubular heat exchanger with 55 spiral microtubes of 3 mm diameter. The second is focused on the evaporation of different refrigerants in a 32 mm diameter tubular heat exchanger. From my point of view, all the set objectives have been met and conclusions have been drawn based on the results of the experiment.

3. SOLUTION METHOD AND CONTRIBUTION OF THE PHD STUDENT

The thesis is systematically solved correctly, has a logical development and proves the ability of the PhD student to apply the methods of scientific work to solve the assigned problem. The thesis used several explanatory methods of scientific work, which include empirical and general theoretical methods. From the general theoretical methods, the analysis of the problem, synthesis of knowledge, elaboration of hypothesis, analogy were used. Among the empirical methods, experiment and simplified numerical modelling were also used. The methods used to address the individual objectives of the thesis are chosen appropriately and proportionately to the problems addressed. The results published in the thesis are presented in the team, with the author being a member of the team cited in 3 and 4 places.

I recommend that during the defense, the PhD student should indicate which specific work he performed on the presented results. At the same time, I miss a more detailed description of the experimental procedure and the evaluation of the measured data in tabular or graphical form and their use for conclusions especially in the evaporation study part.

4. IMPORTANCE FOR PRACTICE OR DEVELOPMENT OF THE RESEARCH FIELD

The presented work is of particular importance for the development of the field. Very valuable are the results obtained by experiments, which confirmed the validity of the published theoretical procedures also on modern equipment in the field of heat exchangers. I also consider the comprehensive and clear summary of the current state of knowledge in the field to be beneficial.

5. FORMALITY AND LANGUAGE LEVEL

The submitted work is processed on a high formal and graphic level with the final impression of a carefully prepared work. The thesis is in technical English, the use of technical terms is unremarkable, the number of errors and typos correctable with common proofreading tools is negligible. Citations and references to sources used are given in accordance with the citation rules.

6. QUESTIONS AND SUGGESTIONS

I have several comments and questions related to presented work:

- Pg. 25, 31 In the overview and later in the paper, the value of mass flux is given in units of $[\text{kg}\cdot\text{m}^{-2}\cdot\text{s}^{-1}]$. To what area or surface of the tubular heat exchanger does the figure m^2 refer?
- Pg. 32 You state that the experiment was carried out with co-author software, but this is not given. What is your contribution to the experiment?
- Pg. 33-35 - no source is given for Figures 4.7-4.9 - are these images by the author?
- Pg 42 Figure 4.13 Please explain in more detail the content of the figure and what conclusions you have drawn from it .
- Pg 46 you give the mass flow rate in $\text{m}^3 \text{hour}^{-1}$, then in $\text{g}\cdot\text{s}^{-1}$ in the text. What is the correct unit?
- Pg 48 Figure 5.5 - unreadable figure caption without source

7. CONCLUSION

The above comments do not detract from the importance of this highly technical, experiment-based work. I appreciate the collaboration on results published in international publications. The thesis fulfils the conditions of the law, as specified in Article 47(4). The student has demonstrated creative abilities in dealing with scientific and whether the thesis meets the standard requirements for a dissertation in the field of

Since the submitted work meets the requirements for this type of qualifying work, I recommend that Ing. Tomáš Fečner to be awarded the degree of PhD on the basis of a successful defence.

V Praze, 12.3.2022

prof. Ing. Karel Kabele, CSc.