ČVUT
ČESKÉ VYSOKÉ UČENÍ TECHNICKÉ V PRAZE

# REVIEWER'S OPINION OF FINAL THESIS

## I. IDENTIFICATION DATA

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|---|---|
| **Thesis name:** | **Comparison of instrumentation for online measurement of particle emissions from direct injection spark ignition engines** |
| **Author's name:** | **Sairam Polasa** |
| **Type of thesis :** | MASTER'S THESIS |
| **Faculty/Institute:** | Faculty of Mechanical Engineering |
| **Department:** | Department of Automotive, Combustion Engine and Railway Engineering |
| **Thesis reviewer:** | Ing. Martin Pechout, Ph.D. |
| **Reviewer's department:** | Department of Vehicles and Ground Transport, Czech University of Life Sciences |

## II. EVALUATION OF INDIVIDUAL CRITERIA

**Assignment** — **Challenging**

*Evaluation of thesis difficulty of assignment.*

The assignment itself does not seem to be very difficult, but requests processing and offers substantial data analysis to obtain maximum possible results. It also requested remarkable effort spent on experimental setup and execution.

**Satisfaction of assignment** — **Satisfied with objections**

*Assess that handed thesis meets assignment. Present points of assignment that fell short or were extended. Try to assess importance, impact or cause of each shortcoming.*

Basically, the comparison of instrument responses has been done, but many methods of comparison and ways to increase the information value of the results are omitted. Only the overall cycle based values (averaged size spectra and concentrations and masses) are compared. A comparison of instrument responses during part of the cycle at more or less constant particles output would be much more beneficiary than rough comparison of overall average spectra, concentration and mass. A comparison of the response times of individual instruments is also completely omitted. In the part dedicated to comparison of fuels a more detailed investigation was expected, for example production of particulate matter during which part is most affected by alcohol fuel and if is the portion of cycle affected by the cold start fuel independent.

**Method of conception** — **D**

*Assess that student has chosen correct approach or solution methods.*

There are several things to be done in much more appropriate way. First of all, the EEPS background should be subtracted before application of the dilution factor (multiplication concentrations by 450). Second, the signal to noise ratios for EEPS and MSS are difficult to believe. Background values for of both instruments seem to be very, very high as displayed in Table 6.10 (in case of MSS not corresponding to level shown in the graph 6.33). Such levels of SNR would make both instruments implausible for any research. Third, comparing any value with standard deviation about half of its magnitude has no value (e.g. Fig. 6.13).

**Technical level** — **D**

*Assess level of thesis specialty, use of knowledge gained by study and by expert literature, use of sources and data gained by experience.*

It does not look like the student get important information about sampling of the particles. The absence of information about sampling lines for raw exhaust sampling (length, temperature at which each line is heated if any) are completely missing in the text and scheme (Fig. 4.1). The correlation of concentrations reported by two instruments over a part of cycle with varying concentrations of particles as in research papers commonly used and described method is also completely missing. There is also missing a comparison of both cold start done morning and afternoon as convincing evidence that two hours cooling period is sufficient.

There is no remarkable effort done to investigate high variability of individual gasoline runs (e.g. comparison of engine control unit reported or independently measured air to fuel ratio).

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| **Formal and language level, scope of thesis** | **D** |
|---|---|
| *Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.* | |
| Also some formal aspects could be improved. The experimental setup is again briefly described in the conclusions part so this information is duplicate.<br>Seconds are used to represent the time in some graphs (e.g. 5.6), but less suitable absolute time with AM/PM notation and fractional steps of minutes in most of the others. There is also a certain amount of grammar mistakes such as "can be measure", "Satring" (last equation on page 49), "In warm start conditions", "in the cold start", duplicative "relative to gasoline fuel" and "compared to Gasoline" in one sentence (p. 80), "n-buatnol". There is also present time used in the Conclusion chapter despite all the results are evaluated and presented.<br>The table listing experiments is present twice (table 3.1 and 5.17). Some of separated graphs contain only little information and their merger would make the thesis more readable and arranged. When any comparison is done, is useful to keep same scale (e.g. set of pictures 6.7, 6.8 and 6.9). Some of the size distributions graphs comparing EEPS and ELPI do not contain mean diameter of each size bin illustrating lower size resolution of ELPI (e.g. Fig. 6.18). | |

| **Selection of sources, citation correctness** | **C** |
|---|---|
| *Present your opinion to student's activity when obtaining and using study materials for thesis creation. Characterize selection of sources. Assess that student used all relevant sources. Verify that all used elements are correctly distinguished from own results and thoughts. Assess that citation ethics has not been breached and that all bibliographic citations are complete and in accordance with citation convention and standards.* | |
| The chosen sources are relevant to the topic of the thesis and they are correctly used. On other hand, some more illustrating graphics would increase the description level especially in chapter 1.4 (formation of PM). Supervisor suggested materials were completely ignored by the student. | |

| **Additional commentary and evaluation** |
|---|
| *Present your opinion to achieved primary goals of thesis, e.g. level of theoretical results, level and functionality of technical or software conception, publication performance, experimental dexterity etc.* |
| Despite many months since the experiments passed no extensive effort has been spent in order to perform more detailed and descriptive analysis of the results and valuable and well arranged presentation of result. At some places a lot of attention is paid on basic aspects (such as comparison of logarithmic and linear scale of particle size) while some obvious and important trends to investigate and to show are ignored.<br>As a result there is only limited added value in terms of instruments and fuels comparison related to particulate matter production so I suggest **grade D**. |

## III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION

*Summarize thesis aspects that swayed your final evaluation. Please present apt questions which student should answer during defense.*

In the chapter 5.5 is listed an Observer in repeatability conditions. Automatically conducted test with recording all the data is assumed so could you comment the role of Observer in such case?
Could you address the basic construction approaches of injector and fuel spray setup related to piston position, air flow and mixture formation and their effects on particulate matter production?

Significant reduction of particles number production has been reported when butanol-gasoline mixtures are used. Could you comment on the possible influences causing such difference? Correct adaptation of the engine control unit maintaining unchanged air to fuel ratio is assumed.

I evaluate handed thesis with classification grade **D.**

Date: **31.8.2020**

Signature: