Response to **Reviewer's 2** Comments and Suggestions

*At the very beginning, we would like to thank you for analyzing our study and preparing the review. The aim of our work was to investigate selected properties of the oil film generated in the torsional vibration damper. The issues discussed by us are characterized by high complexity and the article is a briefed in form due to, for example, limited number of pages. So, we explain as below.*

**Ad. 1.** The tangential force in Figure 1 has the same "T" notation as the temperature in Figures 8-10 and Formulas 3-5. The capital letter "T" is usually used for temperatures in degrees Kelvin. The authors are not consistent in their temperature determinations. For example, Formula 5 - should be a lowercase "t"

*The symbols have been standardized, reorganized and changed throughout the text in accordance with DIN 31652.*

**Ad. 2.** Lack of explanations for the symbols appearing in figures 1, 6, 12. The symbols given at the end of the text (lines 304 - 317) are not complete.

*Abbreviation table has been accompanied with the missing symbols used in the calculation model.*

* for example, in Fig. 1 there are no markings: N, r. In the caption of Fig. 1 there are Polish markings "DMP, GMP" - it should be TDC, BDC. The drawing should be marked with a) and b).

*Figure 1 together with the caption have been changed and enhanced in accordance with the comments of the reviewer.*

* in fig. 4 there is the value "h". There is no explanation in the text of what it is and what the values assigned to it mean.

*Symbol "h" in fig. 4 means the number of harmonic order of vibrations it is added to the figure caption*

* nothing follows from figure 11 and seems to be redundant. What is the relationship of this drawing with the model shown in Fig. 12.

*Figure 11 just shows thermal damage of the engine crankshaft vibration damper. Hence, the research on the operating temperature of the damper has a serious practical justification, and the results presented in the further part of the article constitute a significant contribution to the research on viscous torsional vibration dampers and their durability and reliability. Fig 11 shows the real damper, while the fig. 12. shows only a simplified damper model for explanation the calculation model.*

**Ad. 3.** Line 75 - Damage to the crankshaft can also be caused by excessive wear of the journals or connecting rod journals caused by mineral dust particles entering the engine cylinders and then into the oil. It is caused by insufficient filtration of the inlet air to the engine or too low value of the oil film in the combination. Please complete the information in this regard by providing the relevant literature.

*The problem of contaminants coming into the lubricating oil and causing accelerated wear of the crankshaft journals and the need for thorough filtration of the engine inlet air and maintaining the appropriate thickness of the oil film in engine friction pairs was indicated in the introduction and briefly discussed along with additional literature items [1-3].*

**Ad. 4** Figures 1, 6, 12, 14 are of poor quality

*The quality of the drawings has been improved according to the editorial and technical possibilities.*

**Ad. 5** Figure 6 - the equivalent vibration model of the real drive system is not very accurate. Was this model used in the thermohydrodynamic model of the damper?

*The equivalent vibration model of the real drive system (fig. 6) was not used in the thermohydrodynamic model of the damper (fig. 12). This model was extensively used in previous authors' works and here gives only some input data for thermohydrodynamic model like angular relative velocity of damper housing and inertia ring.*

**Ad. 6** The thermohydrodynamic model of the viscous torsional vibration damper (Figure 12) is not very precise and does not fit the description according to formulas 3-5. For example, where is TA and TB oil temperature measured. What does "ff" mean in formula 4. The coordinates (t, s) are marked, where in Figures 8-10 "t" is time. What does the value "z" mean in fig. 12 and what in formula 3. Fig. 12 does not mark the cross-section of the elements. Without a brief description of the structure of this silencer and a correct drawing, it is difficult to understand the operation of this device. Its connection (kinematic bond) with the engine should be shown.

*Figure 12 shows the simplified model of a viscous torsional vibration damper as the base for mathematical model (equations 2-5). It includes information on damper geometry, kinematics and loads. Now the figure and its caption has been reorganized and expanded with additional descriptions, and should be much more precise. The connections of the damper with crankshaft is very simple – the damper housing is directly screwed to the crankshaft end. It seems there is no need to draw it more over it is no important for the model structure. Symbols used in fig 12 have been described in figure caption and abbreviation sections at the end of paper. Some additional information on test stand parameters taken into the model has been also added.*

**Ad. 7** Line 276 - The authors write: Despite certain simplifications made in the model, it takes into account: the nature of excitation from the drive unit, geometric parameters, as well as physical, kinematic and dynamic properties of the damper. Please specify what are the inputs from the drive unit and what are the dynamic inputs of the shock absorber.

*Now the following sentence has been added: "The input parameters for the model, in particular the angular velocities of the damper elements (Figure 7) as well as the geometric and mass dimensions of the damper (Table 1) were determined on a test stand equipped with a six-cylinder diesel engine of the Andoria 6C107 equipped with a factory torsional vibration damper. The damper surface operating temperatures used in model verification (Figure 14) were measured with a laser pyrometer."*

**Ad. 8**. How many cylinders did the engine have in the shock absorber tests.

*It was 6-cylinder engine.*

**Ad. 9.** What does formula 5 mean.

*Formula 5 is used in the model for calculation kinematic viscosity of the damper oil.*

**Ad. 10.** The analysis of the results is very superficial and inaccurate, which is the main disadvantage of this work. Chapter 5 "Analysis of research results" is just a few meaningless sentences. The paper does not present a comparative analysis of the results obtained numerically (theoretically) with the results obtained experimentally (in the abstract the authors write that such an analysis was performed). There is no diagram of the test stand, test conditions and results. Were the tests conducted experimentally on a bench or on an engine?

*The experimental test were performed on the engine test bench. But it is not a topic of the paper. The only data taken from test bench were angular velocity of the damper elements ant damper housing temperature for model validation. Comparative analysis is presented mainly on the temperature chart in fig. 14.*

**Ad. 11.** There is no reason to write such a sentence (lines 282-284): The calculation results showed that the proposed thermohydrodynamic damper model gives a good approximation to reality, as evidenced by the determined range of the correct operating temperature of the damper.
Which, according to the authors, means "a good approximation to reality" and "correct working temperature of the damper ".

*This section has been reorganized.*

**Ad. 12.** The authors write: Line 286 „The measurement of temperature of a real object and its comparison with the theoretically determined temperature range allows for assessing the technical condition of a damper, and consequently, its effectiveness in vibration damping".
How the temperature of the real object was measured, how the authors propose to assess the technical condition of the shock absorber, and how the authors define the effectiveness of vibration damping ?

*This section has been reorganized. The damper surface operating temperatures used in model verification (Figure 14) were measured with a laser pyrometer. Detailed description of the test stand: construction, measurement methodology, etc. is described in the Patent RP No. 233133 -Stand for the preparation of characteristics of small-size torsional vibration dampers*

**Ad. 13**. There are no conclusions or summaries.

*Research work on real objects is costly and labor-intensive. Therefore, the authors, apart from conducting the stand tests, made an attempt to build a theoretical model, which should be considered a great achievement of the conducted research. The results of the bench tests are shown in Figures 8, 9, 10. However, the results of theoretical tests are presented in Figure 14. Some conclusions has been added to the chapter 5.*

**Ad. 14.** There are much newer editions of this item - Bernhardt M., Dobrzyński S., Loth E.: Silniki samochodowe. 2nd Edition, WKiŁ Warszawa 1969.

*The item was changed to the last edition book.*

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*We hope that our answers as well as the introduced changes and improvements satisfy the Honorable Reviewer. Finally, thank you again for your review.*
*Yours faithfully,*
*Authors*