Clarification Questionnaire Exemption Request 2021-1

Exemption Request for "Mercury in melt pressure transducers for capillary rheometers at temperatures over 300°C and pressures over 1000 bar "

Abbreviations and Definitions

EEE	Electrical and Electronic Equipment
RoHS	Directive 2011/65/EU on the Restriction of Hazardous Substances in Electrical and Electronic Equipment

Background

The Oeko-Institut has been appointed by the European Commission, within a framework contract[1], for the evaluation of applications for exemption from Directive 2011/65/EU (RoHS), to be listed in Annexes III and IV of the Directive.

Your organisation (Netzsch Gerätebau GmbH) has submitted a request for the above-mentioned exemption, which has been subject to an initial evaluation. A summary of the main argumentation for justifying the request is provided below as a first basis to be used in the stakeholder consultation planned as part of this assessment.

Please read the summary of the argumentation provided to ensure that your line of argumentation has been understood correctly and provide answers to the questions that follow that address aspects requiring additional information and/or clarification.

1. Summary of argumentation of applicant on the justification of the exemption

1.1. Background

The applicant seeks to use 100% mercury in a melt pressure transducer in capillary rheometers as a medium to transmit pressure in extreme conditions of up to 440°C and 2000bar. The capillary rheometer analyses the viscosity e.g. of melted polymers to predict its behavior e.g. for an extrusion process. In extruders, mercury filled melt pressure transducers are already used as they are excluded by the RoHS directive. Another currently approved exemption regarding transducers addresses a completely different functionality, application and hazardous substance and are not applicable in this case.

In lower pressure ranges (up to 1000bar), mercury is substituted by sodium potassium (NaK). If these instruments are used also at high pressure, the front membrane will be damaged due to the compressibility of NaK.

[1] The contract is implemented through Framework Contract No. ENV.B.3/FRA/2019/0017, led by Ramboll Deutschland GmbH.

Another substitute is made of gallium, indium and tin (Galinstan). This tends to react with the capillary material above 300°C.

The applicant does not provide information about activities carried out to date or which are planned to substitute mercury in the context of the application at hand.

1.1.1. Volume of Mercury to be placed on the EU market through the exemption

The amount of mercury entering the EU market annually through application for which the exemption is requested is provided by the applicant. However, the applicant requests to keep the information confidential as the estimates are based on company sales data.

1.2. Technical description

Mercury is used as a filling in the pressure transducer of the capillary rheometer to transmit the pressure of the probe to a sensor outside the high temperature and pressure area. Mercury is liquid in the range of operation with a very low compressibility and reactivity. The operation temperature ranges from room temperature to 440°C, the pressure is up to 2000 bar.

1.3. Applicant's justification for the requested exemption

1.3.1. **Availability of alternatives** *(Substitution or Elimination, roadmap to substitution, reliability of substitutes)*

Two potential substitutes are very common as a filling in melt pressure transducers but are limited in the application range.

In lower pressure ranges (up to 1000bar), mercury is substituted by sodium potassium (NaK). If these instruments are used also at high pressure, the front membrane will be damaged due to the compressibility of NaK. The applicant did not provide any quantitative information on the compressibility factor of the filling, that keeps the membrane of the transducer intact in the range of operation. According to literature[2], mercury is known to have a compressibility of $3.7 \cdot 10^{-11}\ \mathrm{Pa}^{-1}$.

Another substitute is made of gallium, indium and tin (Galinstan). This tends to react with the capillary material above 300°C.

1.3.2. **Environmental and health arguments** *(also LCA aspects)*

The applicant refers to the fact that the impacts of mercury are well known and that most manufacturers take back used/old/malfunction melt pressure transducers.

1.3.3. Socioeconomic impacts

The applicant does not provide any information on socioeconomic impacts.

[2] Young, H. D.; Freedman, R. A.; Ford, A. L. (2012): Sears and Zemansky's University Physics

2. Clarification Questions

1. Please explain why you have submitted the exemption request by April 2021:

    a. Is the application newly developed?

    NETZSCH-Gerätebau GmbH acquired the rheology products in 2020. Before we were not part of rheology analytics market. After learning more about the needed application ranges and checking the market for melt pressure transducers, we applied for this exemption as soon as possible.

    b. How did you and competitors deal with the needed functionality until now?

    We do not know how our competitors deal with this situation. We applied for this exemption as soon as we noticed the need in Hg-filled melt pressure transducers and were not able to make use of any exemptions of the RoHS-directive. Maybe competitors are making use of the exemption for large scale tools/installations, which is in our opinion not appropriate for capillary rheometers.

2. Which competitors manufacture similar devices?

    Göttfert, Instron, Shimadzu, Dynisco, Alpha Technologies and Yasuda are some companies who produce capillary rheometers.

3. From which manufacturer/supplier do you buy the capillary rheometers?

    We, NETZSCH Gerätebau GmbH, are the manufacturer of the capillary rheometers.

4. You mention that mercury filled melt pressure tranducers are already used in other machines like extruders, which are excluded from the RoHS directive (large scale). Please provide information as to the legal status of these mercury-added products according to the Mercury Regulation 2017/852.[3]

    We cannot provide the legal status of industries, that we are not part of. However, we assume, the melt pressure transducers do not fall under the mercury added products in annex II of 2017/852/EU.

5. How will you make sure that the capillary rheometers are taken back by the supplier and are recycled properly at the end of its life? Please provide more details on the take-back system. Please also make reference to the requirements of the Mercury Regulation 2017/852.

    We are planning to inform the customers about the take-back system of the Hg-filled-melt pressure transducers, as well as a label, that those melt pressure transducers are Hg-filled. As all of our customers of the rheometers are professional users, we can expect them to estimate the risks and requirements with Mercury filled products and to make sure it will be recycled properly.

    We have an agreement with our melt pressure transducer supplier, that they will take back all melt pressure transducers. As they receive different melt pressure transducers from different industries, they have a recycle system in place.

[3] REGULATION (EU) 2017/852 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2017 on mercury, and repealing Regulation (EC) No 1102/2008.

6. Are there any attempts to improve the membrane for NaK filling or the capillary material for Galinstan? When could it be available?

   We are only the user of those melt pressure transducers and are not part of the development process. From our latest conversation with the supplier before applying for this exemption, there is no alternative for Hg-filled melt pressure transducers for the mentioned application ranges. Our supplier did a lot of testing with NaK and other filling materials, but they were not successful yet. There is no foreseeable date as of now. Also the market for this exemption is not big enough to sustain extensive research on filling media. Existing filling media were developed by nuclear and military research.

7. Which value for the compressibility factor is required for the filling material?

   After talking with our melt pressure transducer supplier, they had the following information for us. The lower the compressibility is, the better it is in terms of maximum pressure range and temperature drift of the sensor. So far, Mercury has the best compressibility, NaK is higher and oil is higher than NaK. Galinstan should be intermediate between Hg and NaK. Not one of the alternatives can meet the requirements of the application range. We would need a liquid with same or better compressibility as Mercury.

8. As for the amount of mercury entering the EU market annually: Could we report the order of magnitude (or a generous upper bound) of the expected volume mercury entering the EU market through this exemption request?

   As the numbers we provided are confidential and estimated, we would suggest reporting the following information: Approximately less than 50 g/year.