# Exemption Request Form

Date of submission: 08.04.2024 (Added Details: 16.05.2024)

## 1. Name and contact details

### 1) Name and contact details of applicant:

| | | | |
|---|---|---|---|
| Company: | Netzsch Gerätebau GmbH | Tel.: | +49 9287 881 164 |
| Name: | Roman Eiswert | E-Mail: | roman.eiswert@netzsch.com |
| Function: | EHSQ Manager | Address: | Wittelsbacherstraße 42<br>95100 Selb - Germany |

### 2) Name and contact details of responsible person for this application (if different from above):

| | | | |
|---|---|---|---|
| Company: | _____ | Tel.: | _____ |
| Name: | _____ | E-Mail: | _____ |
| Function: | _____ | Address: | _____ |

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## 2. Reason for application:

Please indicate where relevant:

- ☐ Request for new exemption in:
- ☐ Request for amendment of existing exemption in:
- ☒ Request for extension of existing exemption in: Annex IV
- ☐ Request for deletion of existing exemption in:
- ☐ Provision of information referring to an existing specific exemption in:
  - ☐ Annex III ☒ Annex IV

No. of exemption in Annex ~~III or~~ IV where applicable:

**49 (added with COMMISSION DELEGATED DIRECTIVE (EU) 2023/1437 of 4 May 2023**

Proposed or **existing wording**:

Mercury in melt pressure transducers for capillary rheometers at temperatures over 300 °C and pressures over 1 000 bar

Duration where applicable: 7 years (according to Article 5 (2) RoHS-directive)

☐ Other: _____

## 3. Summary of the exemption request / revocation request

Capillary rheometers are analytic devices that allow to determine the viscosity of materials, such as polymer melts, oils or pasty foodstuff, as a function of temperature and shear rate. The results are particularly well suited to predict behavior in high shear rate processes, e.g. extrusion.

Due to their fundamental principle of operation, capillary rheometers require *melt pressure transducers* as an essential component.

This kind of pressure sensor has widespread use also within production processes, namely extruders. These components are thus commercially available from various suppliers. Depending on the material to be investigated or processed, a melt pressure transducer with appropriate pressure and temperature range must be chosen.

The common principle of this kind of transducers is to retrieve the pressure within the liquid or pasty sample by means of a membrane. A suitable filling fluid within a capillary then transmits the pressure to the actual sensing element, which converts pressure to an electrical signal by means of a strain gauge. This electrical signal then undergoes further treatment in a separate, application-dependent electronic setup.

The transducer sold by NETZSCH has to cover a range of up to 440 °C and 2000 bar (30'000 psi). A typical application is to investigate high performance polymers, for instance PEEK (melting temperature 343 °C), under melt processing conditions. For this operation range, there is no commercially available alternative to mercury as a filling material within the melt pressure transducer.

Since the first request for this exemption, there are still no substitutes for mercury available on the market.

Even the Regulation (EU) 2017/852, which is based on the international "Minamata Convention on Mercury" acknowledges this issue with the exemption Annex II 10. "The following electrical and electronic measuring devices except those installed in large-scale equipment or **those used for high precision measurement where no suitable mercury-free alternative is available**". (see 9.)

Therefor we ask you to extend this exemption for 7 years.

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## 4. Technical description of the exemption request / revocation request

### (A) Description of the concerned application:

1. To which EEE is the exemption request/information relevant?

   Name of applications or products: capillary rheometers

a. List of relevant categories: (mark more than one where applicable)

☐ 1
☐ 2
☐ 3
☐ 4
☐ 5
☐ 6
☐ 7
☐ 8
☒ 9
☐ 10
☐ 11

b. Please specify if application is in use in other categories to which the exemption request does not refer: _____

c. Please specify for equipment of category 8 and 9:
The requested exemption will be applied in
☒ monitoring and control instruments in industry
☐ in-vitro diagnostics
☐ other medical devices or other monitoring and control instruments than those in industry

2. Which of the six substances is in use in the application/product?
(Indicate more than one where applicable)
☐ Pb ☐ Cd ☒ Hg ☐ Cr-VI ☐ PBB ☐ PBDE

3. Function of the substance:
Transmitting the pressure within the melt pressure transducer.

4. Content of substance in homogeneous material (%weight): 100%

5. Amount of substance entering the EU market annually through application for which the exemption is requested: less than 50 g Hg yearly
Please supply information and calculations to support stated figure.
See confidential file from initial request
6. Name of material/component:
Melt pressure transducer in capillary rheometers
7. Environmental Assessment: _____
LCA: ☐ Yes
☒ No

**(B) In which material and/or component is the RoHS-regulated substance used, for which you request the exemption or its revocation? What is the function of this material or component?**

Melt pressure transducer in capillary rheometers – functions see 3.Summary of the exemption request / revocation request

**(C) What are the particular characteristics and functions of the RoHS-regulated substance that require its use in this material or component?**

Filling fluid in melt pressure transducer in capillary rheometers – functions see 3.Summary of the exemption request / revocation request

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## 5. Information on Possible preparation for reuse or recycling of waste from EEE and on provisions for appropriate treatment of waste

**1) Please indicate if a closed loop system exist for EEE waste of application exists and provide information of its characteristics (method of collection to ensure closed loop, method of treatment, etc.)**

The manufacturers mostly take used/old/malfunction melt pressure transducers back.

**2) Please indicate where relevant:**

☒ Article is collected and sent without dismantling for recycling

☐ Article is collected and completely refurbished for reuse

☐ Article is collected and dismantled:

- ☐ The following parts are refurbished for use as spare parts: _____
- ☐ The following parts are subsequently recycled: _____

☐ Article cannot be recycled and is therefore:

- ☐ Sent for energy return
- ☐ Landfilled

As we are just the user and not the manufacturer, we cannot answer that. We send the old or malfunctioned transducers back to our EU-suppliers and they recycle them according to WEEE. The transducers are not fixed inseparable in our devices. They are just plugged on the electronic side and screwed in on the pressure side. The “preparation” would be remove from device, package it and send it back.

**3) Please provide information concerning the amount (weight) of RoHS substance present in EEE waste accumulates per annum:**

☐ In articles which are refurbished _____

☒ In articles which are recycled N/A: number of this tranducers used in this exemption which are recycled yearly is very small compared to the number of total transducers used and recycled

☐ In articles which are sent for energy return _____

☐ In articles which are landfilled _____

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## 6. Analysis of possible alternative substances

**(A) Please provide information if possible alternative applications or alternatives for use of RoHS substances in application exist. Please elaborate analysis on a life-cycle basis, including where available information about independent research, peer-review studies development activities undertaken**

Argument in initial-exemption request:
For general usage up to measuring ranges 1000 bar and process temperatures up to 538 °C, it is common to use melt pressure sensors with sodium potassium (NaK) filling instead of mercury. Above measuring ranges of 1000 bar the NaK filling is not suitable, as the compressibility of the NaK is too high which results in an extension of the yield limit of the front diaphragm. The sensor cannot longer meet the specification and gets a pre-damage which causes a short life time. .
In comparison, mercury as filling is less compressible, the sensor works appropriate at higher pressure ranges of 1000 bar.

Beside sodium-potassium filling, it is common to use an eutectic mixture of gallium, indium and tin (Galinstan) instead of mercury. The filling Galinstan is just suitable up to approx. 300 °C. At higher temperatures the filling Galinstan reacts with the capillary material, which results in a defect of the sensor.

Added:
Right now there are no changes to this facts. Our suppliers still rely on mercury. The physical properties of mercury are unmatched. It is an element in the periodic table - 1 of 2 which is liquid at room temperature. And the compressibility is also better than any other known liquid. In addition the used/proposed temperatures and pressures - there is no alternative findings yet. The two known alternatives Galinstan (which is used as a non-toxic mercury in thermometers for example) is not valid. Also NaK is not valid as explained in our proposal (6.A). In addition this exemption was granted not even 1 year ago. Research takes a lot longer.

**(B) Please provide information and data to establish reliability of possible substitutes of application and of RoHS materials in application**

No substitutes available – see summary 6(A)

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## 7. Proposed actions to develop possible substitutes

**(A) Please provide information if actions have been taken to develop further possible alternatives for the application or alternatives for RoHS substances in the application.**

Further alternative filling materials which are suitable in combination of high temperatures (>350°C) and pressure (>1000 bar) are not available.

As we are just the user, we can't do the research. We rely on the market and there was no change. We are in talks with various suppliers and only use the Hg-transducers for the high temperature **and** high-pressure cases. All other cases we offer NaK or Galinstan. The companies and researchers, who use our devices need the option to work with Hg-transducers to meet the criteria >300°C >1000 bar for their research. If we are no longer allowed to offer those to them, they either will buy the transducers somewhere else, which can cause broken transducers and more waste or even worse will move their research outside the EU.

**(B) Please elaborate what stages are necessary for establishment of possible substitute and respective timeframe needed for completion of such stages.**

N/A

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## 8. Justification according to Article 5(1)(a):

**(A) Links to REACH: (substance + substitute)**

1) Do any of the following provisions apply to the application described under (A) and (C)?

☐ Authorisation

- ☐ SVHC
- ☐ Candidate list
- ☐ Proposal inclusion Annex XIV
- ☐ Annex XIV

☒ Restriction

- ☒ Annex XVII: Entry 18a: not for electronics/electrical items
- ☐ Registry of intentions

☒ Registration: Provide REACH-relevant information received through the supply chain.

Direct supplier is not registered (< 1t/a), but there are 2 official registries

Name of document: Registrations:

Mercury - Registration Dossier - ECHA (europa.eu)

Mercury - Registration Dossier - ECHA (europa.eu)

**(B) Elimination/substitution:**

1. Can the substance named under 4.(A)1 be eliminated?

   ☐ Yes. Consequences? _____

   ☒ No. Justification: Melt pressure transducers need a fluid filling for transmitting the pressure.

2. Can the substance named under 4.(A)1 be substituted?

   ☐ Yes.

   ☐ Design changes:

   ☐ Other materials:

   ☐ Other substance:

   ☒ No.

   Justification: Substitutes cannot be used at this specific temperature/pressure - See 6. (A)

3. Give details on the reliability of substitutes (technical data + information): No substitutes with required attributes available
4. Describe environmental assessment of substance from 4.(A)1 and possible substitutes with regard to
   1) Environmental impacts: _____
   2) Health impacts: _____
   3) Consumer safety impacts: _____

   Impacts of Hg are already well known – but there are no alternatives for this specific application.

⇨ Do impacts of substitution outweigh benefits thereof?
Please provide third-party verified assessment on this: _____

**(C) Availability of substitutes:**

a) Describe supply sources for substitutes: No availability

b) Have you encountered problems with the availability? Describe: No substitutes with required attributes available

c) Do you consider the price of the substitute to be a problem for the availability?

   ☐ Yes ☒ No

d) What conditions need to be fulfilled to ensure the availability? _____

**(D) Socio-economic impact of substitution:**

⇨ What kind of economic effects do you consider related to substitution?

- ☐ Increase in direct production costs
- ☐ Increase in fixed costs
- ☐ Increase in overhead
- ☐ Possible social impacts within the EU
- ☐ Possible social impacts external to the EU
- ☒ Other: No possibility to substitute. See summary 6a)

⇨ Provide sufficient evidence (third-party verified) to support your statement: _____

## 9. Other relevant information

**Please provide additional relevant information to further establish the necessity of your request:**

Today mercury filled melt pressure transducers are already used in other machines like extruders, which are excluded from the RoHS directive (large scale). With capillary rheometers you are able to control/check the quality of your process before using the large scale extruders, therefore safe resources and power. The number of additional mercury filled pressure transducers, which will enter the market because of this exemption, compared to the already used ones is significantly less.

Capillary rheometers are used in specific professional fields of work only and are not easily movable. Therefore, they are comparable with large scale tools, which are excluded from the RoHS-directive.

The Regulation (EU) 2017/852, which is based on the international "Minamata Convention on Mercury" acknowledges this exemption as well with its exemption Annex II 10. "The following electrical and electronic measuring devices **except** those installed in large-scale equipment or **those used for high precision measurement where no suitable mercury-free alternative is available".** We develop and produce our analytical devices for research and development and for quality control applications, therefor the accuracy/precision is always as high as technically possible and/or available on the market, therefor this mentioned Minamata exemption is exactly describing our case. We use the market available pressure sensors with Hg-filling, which have the highest precision for its task. The mercury directive mentions that exemption, because there is no better alternative. Attached is the datasheet of our rheometers where you can find the accuracy of the transducers of 0,25% and the information on the used high-precision die. The viscosity-range is highly dependent on the processing conditions and material types, so you cannot tell the range. (higher shear-rate leads to higher pressure, lower shear-rate to lower pressure).

The high precision part is on the pressure sensor accuracy of 0,25% full scale output (best on market) - (for example for 2000 bar sensor it is +/- 5 bar error).

The knowledge of the pressure and the volumetric-flow-rate, which depends on the bore-diameter of barrel (+/- 5µm) and speed of piston (min. 0,003 mm/min; up to 1200 mm/min) allows us the determination of the viscosity. As you can see on the low number for piston speed, employing high accuracy pressure sensors are crucial for high precision viscosity measurement.

Because of this argumentation, we strongly ask you to extend this exemption for 7 years.

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## 10. Information that should be regarded as proprietary

**Please state clearly whether any of the above information should be regarded to as proprietary information. If so, please provide verifiable justification:**

The number of sold pressure transducers was based on confidential company sales data and therefore submitted separately with the first exemption application in 2021.

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