Exemption Request Form

Date of submission: January 20th, 2015

1. Name and contact details

1) Name and contact details of applicant:

Company:	JDS Uniphase Corporation	Tel.:	+1 408-546-4520
Name:	Dr. Gabriela Janusz-Renault	E-Mail:	gabriela.janusz-renault@jdsu.com
Function:	Sr. Manager, Compliance and Corporate Social Responsibility	Address:	430 North McCarthy Blvd., Milpitas, CA 95035, USA

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

Company:	JDS Uniphase Corporation	Tel.:	+1-408-546-4363
Name:	Thea Buchanan	E-Mail:	thea.buchanan@jdsu.com
Function:	Product Engineering	Address:	430 North McCarthy Blvd., Milpitas, CA 95035, USA

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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
- ☐ 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: 32

Proposed or existing wording: existing wording

"Lead oxide in seal frit used for making window assemblies for Argon and Krypton laser tubes"[1]

Duration where applicable: 5 years

[1] JDS Uniphase Corporation doesn't manufacture Krypton lasers therefore, only Argon lasers are in focus of this application.

☐ Other: _____

3. Summary of the exemption request / revocation request

JDSU Argon laser products are used as coherent light sources in a broad range of critical applications, a majority of which are in research, bioinstrumentation and semiconductor manufacturing.

Leading manufacturers of flow cytometers, DNA sequencers, and hematology equipment incorporate JDSU Argon lasers into their products for both new production and service of a large worldwide installed base. Instruments are used internationally by both government and private sector agencies for health care, drug discovery, and research applications.

In semiconductor manufacturing, JDSU Argon lasers are used in inspection equipment, again for both new installations and service business.

The lead-oxide based material is used in JDSU's Argon laser products to provide a critical thermo-mechanically-stable and vacuum-tight seal between the optics and laser tube. The softening point of the lead-oxide material occurs at a narrow temperature range around 420°C, and does not thermally damage the nearby fragile components being joined. Additionally the material has a coefficient of thermal expansion closely matched to the components for stress-free sealing.

The commercially available alternatives to the lead based sealing glass are bismuth based. The bismuth based glasses have a significantly higher (540°C) melting temperatures than the lead based glasses.

JDSU has tested the initial suitability of bismuth based alternatives. While the published melting temperature is 540°C, in trial builds processing temperatures in excess of 560°C did not produce good flow of the frit material. The coverage of the frit material should be complete as in the photo on the left. As seen in the photo on the right, the lead-free material did not flow to provide a complete seal.

Figure 1: *Lead based frit after processing*

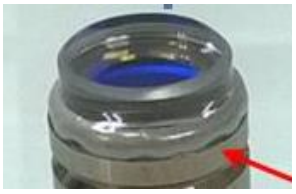

Figure 2: *Bismuth based frit after processing*

The processing temperatures are restricted by the potential of damage to the components, primarily the optics. Because the optics utilize complex multilayer coatings (>30 layers) using higher temperatures or longer processing times is not advised by the supplier of the optics. The coating fabrication process only allows for stabilization of the key optical properties to 500°C. Processing at temperatures above 500°C will cause failure of the coatings.

The bismuth oxide material is not considered a viable alternative at this time. Our optics are not designed to be subjected to temperatures beyond 500°C. Testing of the bismuth oxide material even above the specified sealing times and temperatures did not provide the complete sealing needed.

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: _____

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

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

b. Please specify if application is in use in other categories to which the exemption request does not refer: No

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: Lowering of melting temperature in the solder glass

4. Content of substance in homogeneous material (%weight): > 50%

5. Amount of substance entering the EU market annually through application for which the exemption is requested: 17 g

Please supply information and calculations to support stated figure.

Total annual JDSU usage of PbO in the sealing glass in argon lasers is 230 g. However, only fraction of that enters EU. Based on JDSU's direct shipments only 17g of PbO enters EU market in argon lasers.

6. Name of material/component: Solder glass of an argon laser tube.

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?

Lead oxide is in a solder glass frit which is used to provide a critical thermo-mechanically-stable and vacuum-tight seal between the optics and laser tube. Solder glasses are special glasses with a low softening point that is typically below 550°C. JDSU uses solder glass that has a melting point at 420°C. This glass frit joins glass of a mirror to the laser metal tube without thermally damaging complex coating layers of the mirror.

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

Lowering the glass softening point and providing a coefficient of thermal expansion closely matched to the components for stress-free sealing.

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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.)

JDSU manufactures argon lasers that are incorporated further into electrical equipment used for research, bioinstrumentation and semiconductor manufacturing. JDSU's customers in EU have a legal obligation under WEEE Directive to provide appropriate treatment to the EEE waste however, JDSU as a component manufacturer does not have a visibility of these processes.

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

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 17 g

☐ 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

No alternatives exist. See #3.

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

See #3.

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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.

JDSU has tested the initial suitability of bismuth based alternatives. While the published melting temperature is 540°C, in trial builds processing temperatures in excess of 560°C did not produce good flow of the frit material to seal the optics (see figure 2).

The processing temperatures of the sealing glass are restricted by the potential of damage to the components, primarily the optics. Because the optics utilize complex multilayer coatings (>30 layers) using higher temperatures or longer processing times is not advised by the optics supplier. The coating fabrication process only allows for stabilization of the key optical properties to 500°C and processing at temperatures

above 500°C causes failure of the coatings. Therefore the bismuth oxide glass is not considered a viable alternative to the lead based sealing glass. Testing of the bismuth oxide material even above the specified sealing times and temperatures did not provide the complete sealing needed.

In addition to the softening temperature below 500°C the seal frit is required to have the thermal expansion coefficient at 7.0 to 8.0 10^{-6}/K to match to the components for stress-free sealing. JDSU has not identified lead-free glass that meets these requirements. The table below summarizes the coefficients of thermal expansion and the sealing temperature of leaded and lead-free sealing glass and sealed components.

***Table 1**: Comparison of the coefficients of thermal expansion and sealing temperature of leaded and lead-free sealing glass and sealed components in the argon lasers.*

Material	Coefficient of Thermal Expansion [10^{-6}/K]	Sealing Temperature [°C]
G017-340 (leaded glass)	7.0	420
G018-250 (lead-free glass)	7.0	540
Optic	7.1	n/a
Holder	8.3	n/a

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

JDSU has not identified lead-free sealing glass that would have a softening point below 500°C and a thermal expansion coefficient suitable for use in the argon lasers.

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: No

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

☐ Restriction: No

- ☐ Annex XVII
- ☐ Registry of intentions

☐ Registration: No. Registration is not applicable to articles. Also registration of glass is exempt (Annex V of REACH Regulation).

Lead based glass is manufactured from lead oxide and other compounds. These substances chemically react during the glass manufacturing process and form complex mixed oxide material that is not classified as SVHCs and not listed in REACH Annexes.

2) Provide REACH-relevant information received through the supply chain.
Name of document: Not applicable.

(B) Elimination/substitution:

1. Can the substance named under 4.(A)1 be eliminated?
   - ☐ Yes. Consequences? _____
   - ☒ No.

   Justification: Lead-free alternatives with a matching thermal expansion coefficient have higher softening point. Due to higher processing temperatures they are not suitable for sealing of optics in argon lasers as it would damage the optics coating.
2. Can the substance named under 4.(A)1 be substituted?
   - ☐ Yes.
     - ☐ Design changes:
     - ☐ Other materials:
     - ☐ Other substance:
   - ☒ No.

   Justification: Bismuth based glasses are not suitable for the sealing of the optic components to the Argon laser tube due to softening point above 540°C. Temperature above 500°C damages complex coating of the laser mirrors.
3. Give details on the reliability of substitutes (technical data + information):
   See Annex-1 for technical datasheets.
4. Describe environmental assessment of substance from 4.(A)1 and possible substitutes with regard to
   1) Environmental impacts: Negligible due to small amount of PbO used.
   2) Health impacts: No due to small amount of PbO used.
   3) Consumer safety impacts: No.

⇨ Do impacts of substitution outweigh benefits thereof? Not applicable.
Please provide third-party verified assessment on this: _____

(C) Availability of substitutes:

a) Describe supply sources for substitutes: None

b) Have you encountered problems with the availability? Describe: Not applicable

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? Not applicable

(D) **Socio-economic impact of substitution:** Not applicable for the exemption renewal application

⇨ 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: _____

⇨ 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:

Argon lasers cannot be manufactured without the use of lead oxide in seal frit of the window assembly and without argon lasers many applications would not be possible. That includes instruments used in healthcare and research like flow cytometers, DNA sequencers, hematology equipment as well as equipment for bioinstrumentation and semiconductor manufacturing.

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:

None of the information is proprietary.