

Exemption Request Form

Date of submission: 16/01/15

1. Name and contact details

1) Name and contact details of applicant:

Company: Knowles Capacitors

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Name: Stephen Hopwood






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Function: Snr Application Eng.

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With support from :

<p>Amphenol Aerospace</p>		<p>Filconn</p>		<p>Hirel Connectors</p>	
<p>ITT Cannon</p>		<p>Glenair Inc.</p>			

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

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

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: 24

Proposed or existing wording: Lead in solders for the soldering to machined through hole discoidal and planar array ceramic multilayer capacitors

Duration where applicable: We apply for renewal of this exemption for categories 1 to 7, 10 and 11 of Annex I for an additional validity period of 5 years. For these categories, the validity of this exemption may be required beyond this timeframe. Although applications in this exemption renewal request may be relevant to categories 8 & 9 this renewal request does not address these categories. Further, categories 8 & 9 have separate maximum validity periods and time limits for application for renewals

Other: _____

3. Summary of the exemption request / revocation request

Discoidal and planar array capacitors are derivations of MLCC's with the opposing terminations made to the outside periphery and the inside diameter of holes drilled through the ceramic body. They are specialist capacitors used in EMI filters and EMI filtered connectors for high end applications, where the elimination of electrical interference is critical. Typical applications for assemblies incorporating these components and covered by the RoHS directive include professional audio equipment, Maritime monitoring (coastguard radar) and CCTV systems

In application, signal carrying feedthrough pins are passed through the ceramic element and connected to the internal bore to make a mechanical and electrical

connection. This connection must have low electrical resistance and inductance for optimum performance, as high resistance / inductance will inhibit the high frequency electrical path to ground through the filtering capacitor.

Traditionally this connection is made by solder, but when lead free solder is used to make the connection, the shrinkage of the solder and pin assembly within the bore exerts a tension force on the inside of the bore sufficient to form micro-cracks in the ceramic element. These cracks have a recognisable shape and form. If the crack propagates through the electrically active portion of the design, where electrodes of opposing polarities overlap each other, then the result can be a low resistance path or an electrical short circuit resulting in failure of the electrical system and potentially health and safety risks to operators.

Lead containing solders, often in conjunction with other metals such as Indium, imparts a degree of ductility to the solder joint, allowing stress release within the joint and absorbing the forces applied to the ceramic.

Alternative solder alloys, such as Sn based lead-free alloys and SnPb alloys, do not have sufficient ductility to prevent stress damage to the ceramic and can represent a reliability / safety risk during the operating life of the component.

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: EMI feedthrough filters and EMI filtered connectors

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

- | | |
|---------------------------------------|--|
| <input checked="" type="checkbox"/> 1 | <input checked="" type="checkbox"/> 7 |
| <input checked="" type="checkbox"/> 2 | <input type="checkbox"/> 8 |
| <input checked="" type="checkbox"/> 3 | <input type="checkbox"/> 9 |
| <input checked="" type="checkbox"/> 4 | <input checked="" type="checkbox"/> 10 |
| <input checked="" type="checkbox"/> 5 | <input checked="" type="checkbox"/> 11 |
| <input checked="" type="checkbox"/> 6 | |

b. Please specify if application is in use in other categories to which the exemption request does not refer: Although applications in this exemption renewal request may be relevant to categories 8 & 9, this renewal request does not address these categories. Therefore we have not completed section 4(A)1.c. Further, categories 8 & 9 have separate maximum validity periods and time limits for application for renewals.

As a component supplier we are not aware of all applications where this product is used, but in general it is for high end applications where performance is more important than cost. They are not generally used in low cost consumer electronics.. We include category 11 to cover unknown applications.

- 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: To impart ductility to the solder joint

4. Content of substance in homogeneous material (%weight): Varies with filter design, but typically 5mg to 10mg per solder joint, equating to ~1.0% of the total component weight (maximum). More complex designs such as filter connectors will be proportionally less as a % of the total weight.

5. Amount of substance entering the EU market annually through application for which the exemption is requested: Estimated at ~ <50kg
Please supply information and calculations to support stated figure.

There is no accurate data available to indicate the amount of lead entering the EU in this type of application, however most applications of these components are not covered by the RoHS directive. Below we have attempted to estimate the volume of lead based on our knowledge of the market and typical solder volumes used.

There are 2 major players in the supply of planar arrays for EMI filtered connectors and we are informed by our customers that we account for ~60% of the market. Our average manufacturing is 357k capacitive holes per week = 18.6M capacitive holes PA, indicating the market is around 31M capacitive holes PA. The nature of these components is such that they are chiefly used for high end applications such as aerospace and military, where technical performance outweighs cost. We estimate from feedback that only around 4%

of parts are supplied into applications covered by the RoHS directive ~1.25M capacitive holes. Based on our earlier calculation that each hole takes up to 10mg of lead in a typical solder joint, the total lead from filtered connectors entering RoHS applications PA is ~12.5kg maximum

With regard to EMI single line filters, we estimate the global market at \$70M with a typical selling price of \$1.50 per line. From this, using the same 4% estimate of parts shipping to RoHS applications, indicates the number of lines soldered would be ~1.9M PA. Again, based on the same lead weight per solder joint of 10mg, this equates to ~19kg of lead maximum.

Adding the 2 figures together gives the estimate of 32kg PA supplied into applications covered by the RoHS directive, allowing for errors and assumptions we apply a figure of <50kg

These calculations take into account feedthrough lines (unsoldered) and filtered connectors making use of spring clip technology.

They do not take into account filters manufactured using HMP solders with a lead content >85% where the high melting point solder is needed to allow step soldering of the finished article or during final assembly of the finished article (covered in part by exemption 7a)

HMP high lead solders have the same ductility benefits as InPb alloys, but obviously the higher lead content and high processing temperatures (high energy usage) mean this is not a sensible substitution to make based on environmental concerns.

6. Name of material/component: Solders for the soldering to machined through hole discoidal and planar array ceramic multilayer capacitors such as are used in the manufacture of EMI Filters & EMI Filtered connectors

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?

Solder used to make electrical and mechanical contact between the internal contact face of the ceramic capacitor and the internal conductor pin of the finished component. The alloy used is usually InPb.

Discoidal and planar array capacitors are used in the manufacture of EMI filters and EMI filtered connectors used to suppress electromagnetic interference on signal lines.

By their nature, these devices are mainly used on high end applications – the majority being used in space / aerospace and military, but some applications exist within the remit of the RoHS directive

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

The solder must have good ductility down to low temperatures – the Lead Indium compounds used are the only alloys in the ‘standard’ melting temperature range that have the required ductility. The only other alloys having appropriate ductility are high% lead HMP alloys as covered under exemption 7a

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.)

Knowles provide the electronic components to OEM's & CEM's who incorporate them into their application / equipment. As a manufacturer of component level products, Knowles are not aware of the final disposition of EEE at EOL.

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

Recycling is possible. Disposition is determined by the higher level manufacturer.
Knowles cannot answer Q2

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 _____
- In articles which are sent for energy return _____
- In articles which are landfilled _____

Not known. The nature and cost of the component indicates a long lifecycle, so EOL equipment will be minimal. Disposition is determined by the higher level manufacturer. Knowles cannot answer Q3

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**

In some cases it has been possible to replace solder with mechanical connections (see below), but where it is technically necessary to use solder, there are no known replacements for lead containing alloys in this application.

Some connector applications are making use of spring clip technology to make a solderless connection. This technique is well established, but there are limits to its use :

- 1) The technique takes up more physical space, reducing available capacitance and reducing the electrical performance of the device For this reason the use is limited to larger size filtered connectors with wide contact pitch and lower filtering requirements.
- 2) The technique does not provide a 100% grounding ring, so can reduce EMI performance and allow HF noise to pass through.

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

At present there are no known substitutes for lead containing solder alloys for this application.

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.**

We see no scope for replacing solder as the primary method of making electrical and mechanical connection between the capacitor and the through conductor pin.

We continue to monitor the solder industry through web searches and in conjunction with our partner solder supplier Indium Corporation, but there are no viable alternatives to lead containing alloys at the present time.

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

N/A

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
 - Registry of intentions
- Registration

- 2) Provide REACH-relevant information received through the supply chain.

Name of document:

(B) Elimination/substitution:

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

Yes. Consequences? _____

No. Justification: No known alternative providing the requisite joint ductility.

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

Yes.

Design changes:

Other materials:

Other substance:

No.

Justification: No known alternative providing the requisite joint ductility.

3. Give details on the reliability of substitutes (technical data + information): N/A

4. Describe environmental assessment of substance from 4.(A)1 and possible substitutes with regard to

1) Environmental impacts: Not Applicable

2) Health impacts: Not Applicable

3) Consumer safety impacts: Not Applicable

⇒ 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: None

b) Have you encountered problems with the availability? Describe: N/A

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? N/A

(D) Socio-economic impact of substitution: N/A

⇒ 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:

Technical report attached (Application Note AN0011 Solder Alloy Choice for Through Hole Ceramic Discoidal & Planar Array Capacitors.pdf)

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:

There is no information which should be regarded as proprietary information
