1.9 Attachment: Application Form

Exemption Request Form

Date of Submission: January 3, 2020

1. Name and contact details

1) Name and contact details of applicant:

Company: Bourns Inc. Telephone: 951-781-5008
Name: Cathy Godfrey email: cathy.godfrey@bourns.com
Function: Corporate EHS Manager Address: 1200 Columbia Ave., Riverside, CA USA

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

Same as above

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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:

○ 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: 6c

Proposed or existing wording: __existing wording

Duration where applicable: maximum validity period

○ Other:

3. Summary of the exemption request / revocation request

Bourns, Inc. respectively requests to extend the current exemption 6c, copper alloy containing up to 4% lead by weight. Free-cutting brass (C36000) is a standard alloy of copper and zinc containing about 3% lead. Lead is added to the brass to enhance machinability. Due to the lead content, 360 brass is the easiest material to machine and is the global standard by which the machinability of other alloys is compared. It is known for its strength and resistance to corrosion with properties closely resembling steel. It can be precision machined easily. Brass is a strong material that maintains its strength even under harsh conditions. Brass forms a tin protective patina (unlike steel and iron) that will not rust when exposed to atmospheric conditions. Free-cutting brass is an old and thoroughly understood alloy. 360 Brass' universal applications include screw machine parts, couplings, bushings, connectors, electronic components, valve components, pump shafts, plumbing to name a few.

Bourns, an electronic component manufacturer, uses 360 brass mainly for adjustment shaft screw fabrication and bushings. Screw machines are very precise. The diameters of the 360 brass rod available allow for minimal material removal. Brass turnings are 100% recyclable. If an alternate material was used, more material would be machines increasing time and waste. Without lead in the brass, the screw machines run one-quarter to one-half the standard speed. Tool changes are made 2-3 times as often due to wear. Use of pure copper material is too soft. Many Bourns components use small brass shafts with close tolerances and complex details (e.g. chevron seal). Lead in the brass is necessary for lubrication and chip control in order to run on automatic screw machines. For automatic screw machines (turning), the absence of lead which serves as a lubricant will increase the heat generated requiring a lower surface speed thus slowing down the cycle time. The absence of lead will also make chip control much more difficult. The lead causes the chips to break up into small fragments. If the chip cannot be broken, the material will tangle up and cannot be machined in automatic mode. Since there is no definition of 'small', we can only assume based on Bourns components that the both dimensions and small screw machines require small bar sizes with good machinability to product good shafts, bearings, rivets, etc. Many of the trimming potentiometers in question are less than 1-gram total weight. Other encoders, panel controls and precision potentiometers are larger but still use small internal parts.

Bourns' model families of electronic components using C36000 brass materials:
Encoders: (shafts, terminals, terminal strip)
Panel Controls: (brass shafts, strips, rivets)
Precision Potentiometers: (wiper terminal, terminal, shafts, bushings)
Rotary Sensors: (bushings)
Slide Potentiometers (rivets)
Trimming Potentiometers (shafts)

The C36000 used in the various applications contains approximately 3.1% lead. The following table lists the various Bourns product categories/models containing lead due to the C36000 usage. The unit weight in grams is provided as well as the % lead of the total unit weight based on the C36000:

Product type	Model	unit weight (g)	% Pb in finished unit	use
Precision Potentiometers				
	3500	23.16	0.04	wiper terminal
	3540	13.114	0.27	wiper terminal
	3541	13.657	0.27	shaft
	3543	11.698	0.3	shaft
	3545	12.731	0.28	shaft
	3547	19.352	1.706	shaft and bushing
	3548	19.87	1.661	shaft and bushing
	3590	21.702	1.358	shaft and bushing
	3700	8.428	0.11	wiper terminal
	3701	8.876	0.063	wiper terminal
	3750	7.769	0.065	terminals
	3751	8.762	0.065	terminals
	6537	14.302	0.026	terminals
	6538	14.302	0.026	terminals
	6539	11.92	0.094	terminals
	6574	81.159	0.002	terminals
	6630	15.759	2.17	shaft, terminal, bushing
	6637	21.993	0.202	terminals
	6638	21.993	0.004	terminals
	6639	16.85	0.067	terminals, bushing
	6657	33.012	0.0132	terminal
Panel Controls				
	3851	10.216	1.835	shaft
	3852	10.216	1.835	shaft
	3856	10.216	1.835	shaft
	3862	7.1	1.05	shaft
	39	3.578	0.8543	shaft, strip
	51	10.56	1.94	shaft
	53	10.56	1.94	shaft
	56	10.172	1.711	shaft, rivet
	81	13.65	1.42	shaft
	82	13.65	1.42	shaft
	83	18.69	1.043	shaft
	84	19.75	1.133	shaft

Product type	Model	unit weight (g)	% Pb in finished unit	use
	86	17.778	1.097	shaft
	91	14.069	1.54	shaft
	92	14.069	1.54	shaft
	94	14.069	1.54	shaft
	95	14.08	0.015	shaft
	96	14.08	0.015	shaft
	97	14.069	1.54	shaft
	99	14.069	1.54	shaft
	PTJ	9.967	0.6953	inner/outer shafts
Encoders				
	EM14	12.812	1.336	terminals, shaft
	EN	20.857	0.039	terminal strip
	ES14	9.361	0.5286	shaft
	PTH	9.13	0.85	shaft
Rotary Position Sensor				
	AMS22	15.166	0.849	bushing
	AMM20	17.529	0.738	bushing
Slide Potentiometers				
	PSM01	67.8	0.011	rivet
Trimming Potentiometers				
	3005	1.304	0.5478	shaft
	3006	1.114	0.6195	shaft
	3009	1.3742	0.5324	shaft
	3057	2.69	0.4	shaft
	3057L	2.9654	0.53	shaft
	3059	2.27	0.4738	shaft
	3082	0.285	0.5793	shaft
	3214	0.191	0.1947	shaft
	3223	0.105	0.33	shaft
	3224	0.1906	0.195	shaft
	3250	1.9316	0.1677	shaft
	3252	1.705	0.2286	shaft
	3260	0.39	0.3462	shaft
	3262	0.3834	0.3834	shaft
	3266	0.3834	0.3962	shaft
	3269	0.3834	0.3881	shaft
	3290	0.39	0.3462	shaft
	3292	0.789	0.4	shaft
	3296	0.8324	0.3799	shaft

Product type	Model	unit weight (g)	% Pb in finished unit	use
	3299	0.8374	0.3776	shaft
	PV36	0.8329	0.3184	shaft
	PV37	0.3834	0.3323	shaft
	PVG5	0.191	0.195	shaft

With the wide use of applications for electronic components, subassemblies containing electronic components and finished products containing electronic components, it is not possible for Bourns to determine the final use in the various EEE categories. Once Bourns parts are sold either directly or through distribution, we do not have information on how all parts are used. Bourns' parts are not typically identified as a finished consumer or industrial part on its own; Bourns parts are used in the assembly of other goods such as cell phones and computers. Bourns cannot determine where the global parts that claim exemption 6c are used and the destination of those many finished end-user products. Further, the end products that use these parts may not be under the RoHS scope. There may be applications using this exemption that are out of scope of Bourns customer base. There are just too many unknowns to provide accurate information.

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: Listed are electronic components used as subcomponents in various categories of EEE. Components including brass shafts/bushings/other brass applications include Precision Potentiometers, Encoders, Panel Controls, Rotary Sensors, and Trimming Potentiometers. These electronic components are typically used on circuit boards and other internal electronics of the various categories used by our customers.

   a. List of relevant categories: possibly 1-11 depending on EEE manufacturer using electronic components as part of their assembly.

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

   c. Please specify for equipment of category 8 and 9.

      Our company does not manufacture equipment; our components may be used by manufacturers of categories 8 and 9.

2. Which of the six substances is in use in the application/product?

   ●Pb ○Cd ○Hg ○ Cr-VI ○PBB ○PBDE

3. Function of the substance: Pb in 360 brass for machinability

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

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

   Name of material/component: 360 Brass included in:

   Passive electronic components Precision Potentiometers, Encoders, Panel Controls, Rotary Sensors, and Trimming Potentiometers.

   Since a majority of Bourns components are sold by distribution, it is not known exactly the amount of components including 360 Brass entering the EU per total components sold.

6. Environmental Assessment:

   LCA: Yes, see examples below

   There are examples of LCA for the metal industry available on the Internet. They are overviews of the impacts of mining to refining.

   KME Germany AG & Co. Summary page
   https://www.kme.com/fileadmin/user_upload/GERMANY_AUB_Environmental_Product_Declaration_TECU.pdf

   European Copper Institute
   https://copperalliance.eu/resources/comments-socio-economic-analysis-copper-alloys-ecis-input-public-consultation-proposal-restriction-lead-compounds-articles-intended-consumer-use/?download=please

   Stainless steel LCA information for comparison:
   https://www.bssa.org.uk/cms/File/Conf%2003%20Global%20SS%20Life%20Cycle%20Inventory.pdf

   Life Cycle Assessment of Metals: A Scientific Synthesis (Abstract)
   https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4085040/

(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?

Various electronic components use internal parts including brass shafts and bushings. 360 Brass which includes up to 4% lead is the copper alloy of choice due to its machinability. For screw machines, 360 Brass is offered in appropriate rod sizes to minimize waste and optimize production time.

Some alternatives have been tested in the past. ECO brass was previously evaluated for machining capability. Our plant had difficulty in machining this material at that time. We recently spoke to an ECO brass distributor. The problem for Bourns is the smallest diameter bar available is 0.250". For example, some trimming potentiometers require a diameter size of 0.075". Using a 0.250" would mean 91% waste if machined down to 0.075".

Some alternatives tested and problem areas include:

- Aluminum – slow machining
- Zinc die cast – seal integrity issues
- Nickel silver – required slowing screw machine by 50%; material finish not as good as brass.

All three alternatives have a higher raw material cost, a slower machining rate which reduces our capacity and shortens tool life.

Bourns continues to work with our current and potential suppliers, explore possible solutions, experiment with possible alternatives. We are currently evaluating other potential alternatives that offer rod diameters that would not result in a more significant amount of waste material than usable parts. Identification of these potential alternatives are proprietary at this time. It is a slow process with research, experimentation, testing, scale-up, qualification & reliability testing. If there is a failure along the way, the process starts over.

Examples of Bourns' components utilizing 360 Brass include Precision Potentiometers, Encoders, Panel Controls, Rotary Sensors, and Trimming Potentiometers.

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

Free-cutting brass (C36000) is a standard alloy of copper and zinc containing about 3% lead. Lead is added to the brass to enhance machinability. Due to the lead content, 360 brass is the easiest material to machine and is the global standard by which the machinability of other alloys is compared. It is known for its strength and resistance to corrosion with properties closely resembling steel. It can be precision machined easily. Brass is a strong material that maintains its strength even under harsh conditions. Brass forms a tin protective patina (unlike steel and iron) that will not rust when exposed to atmospheric conditions. Free-cutting brass is an old and thoroughly understood alloy.

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.)

   Electronic components alone are not typically listed as EEE. These components are a subassembly parts used to build the inner electronics workings of specific EEE. Electronic components at end of life are typically classified as electronic waste. In the US, the EPA classifies electronic waste as universal waste and requires specific handling. It is unknown the methods of handling/treatment globally. During the machining process the brass, turnings and scrap pieces are fully recyclable.

2) Please indicate where relevant: All answers may be applicable for various EEE manufacturers.

   ● Article is collected and sent without dismantling for recycling (example: electronic waste) or

   ● Article is collected and completely refurbished for reuse (components as a part of the EEE article), or

   ● Article is collected and dismantled (components as a part of the EEE article), or:

   ○ The following parts are refurbished for use as spare parts: ___
   ○ The following parts are subsequently recycled: ____

   ● Article cannot be recycled and is therefore (components as a part of an EEE article that is not recyclable)

   ○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 unknown

   ○ In articles which are recycled unknown

   ○ In articles which are send for energy return unknown

   ○ In articles which are landfilled unknown

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:

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

(A)+(B) discussion: Lead is added to the C360 Brass to enhance machinability. Due to the lead content, 360 brass is the easiest material to machine and is the global standard by which the machinability of other alloys is compared. It is known for its strength and resistance to corrosion with properties closely resembling steel. It can be precision-machined easily. Brass is a strong material that maintains its strength even under harsh conditions. Brass forms a tin protective patina (unlike steel and iron) that will not rust when exposed to atmospheric conditions. Free-cutting brass is an old and thoroughly understood alloy. 360 Brass universal applications include screw machine parts, couplings, bushings, connectors, electronic components, valve components, pump shafts, plumbing to name a few.

Bourns uses 360 brass for adjustment shaft screw fabrication and some bushings. Screw machines are very precise. The diameters of the 360 brass rod available allow for minimal material removal. Brass turnings are 100% recyclable. If an alternate material was used, more material would be machines increasing time and waste. Without lead in the brass, the screw machines run one-quarter to one-half the standard speed. Tool changes are made 2-3 times as often due to wear. Other uses for some Use of pure copper material is too soft.

https://www.reach-metals.eu/uploads/pdf/Substitution%20Workshop%2007.11.2018/4-%20Klaus%20Ockenfeld%20lead%20substitution.pdf

Reviewing the LCA literature found for two copper organizations, it does not appear changing from one type of copper to another would change anything in the LCA. The same process from mining to refining would occur. Copper scrap and turnings can be 100% recycled. For comparison, LCA information from the stainless steel industry was reviewed. It is very similar due to the mining to refining process. The LCAs did provide information on their individual processes and typical LCA data. The steel industry also uses scrap material back into the process.

https://copperalliance.eu/resources/environmental-profile-copper-products-cradle-gate-life-cycle-assessment-copper-tube-sheet-wire-produced-europe

From a downstream user point of view, both copper and stainless steel are similar in the life cycle assessment. For our operation, the 360 Brass allows more efficient use of time due to the machinability, less scrap due to the rod sizes available for the screw machines, recyclability of scrap/turnings. The alternative using stainless steel is more expensive, has a slower machining rate which reduces production capacity and shortens tool life.

High Speed Machining Advantages of Brass vs Steel, Copper Development Association, Inc.
https://www.copper.org/applications/rodbar/pdf/a7050-brass-vs-steel.pdf

Free-Cutting Brass (Alloy 360) for Automatic Screw Machine Products, Copper Development Association, Inc.
https://www.copper.org/applications/rodbar/alloy360/free_cutting.html

Comparing Brass Versus Stainless Steel Threaded Inserts, Machine Design
https://www.machinedesign.com/materials/article/21831579/comparing-brass-versus-stainless-steel-threaded-inserts

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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 the application or alternatives for RoHS substances in application.

The only alternative to a copper alloy is stainless steel which is inferior to the 360 Brass. Stainless steel has a higher cost of machining. Machinability ratings indicate that stainless steel is 40-50% as efficient as brass. Stainless steel is a poor conductor of heat compared to brass. This results in elevated temperatures during machining operations reducing the life of tooling. Rod sizes for screw machines are readily available in 360 brass; not available in stainless without more scrap/waste. Other lead-free brass alloys do not have the same machining attributes as the 360.

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

At this time, there is no suitable substitute for 360 Brass without reduced production and increased tooling costs. 360 Brass is the standard alloy for automatic screw machine products. Bourns continues to test potential alternatives.

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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 (lead)
- ○ Candidate list
- ○ Proposal inclusion Annex XIV
- ○ Annex XIV

○ Restriction
- ○ Annex XVII
- ○ Registry of intrusions

○ Registration

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

Name of document: Registration dossier for copper: https://echa.europa.eu/registration-dossier/-/registered-dossier/15562

(B) Elimination/substitution:

1. Can the substance named under 8(A)1 be eliminated?

○ Yes. Consequences? _____

● No. Justification: lead needed for machinability

2. Can the substance named under 8(A)1 be substituted?

○ Yes.

○ Design changes:
○ Other materials:
○ Other substance:

● No:

Justification: no suitable substitute to date per reasons within this application

Give details on the reliability of substitutes (technical date + information): _N/A___

3. Describe environmental assessment of substance from 8(A)1 and possible substitutes with regard to:

1) Environmental impacts: at this time, substitutes would have to come from the brass family. The environmental assessment would be basically the same from the LCA standpoint. LCA for copper mining/processing from the Copper Alliance is available:

https://copperalliance.eu/resources/environmental-profile-copper-products-cradle-gate-life-cycle-assessment-copper-tube-sheet-wire-produced-europe/

2) Health impacts: See LCA
3) Consumer safety impacts: see LCA

→ Do impacts of substitution outweigh benefits thereof?
Please provide third-party verified assessment on this: No details currently.

(C) Availability of substitutes:

a) Describe supply sources for substitutes: N/A
b) Have you encountered problems with the availability? Describe: yes, with rod size availability of some alloys – too large of diameter results in >90% waste.

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

○ Yes ○ No

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

(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: _____

→ Provide sufficient evidence (third-party verified) to support your statement: no third party information. Direct production costs based on change from brass to stainless steel discussed in 7 A&B. Also amount of waste for using other copper alloys and unavailable small rod size currently.

9. Other relevant information

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

We believe this exemption should not be eliminated. 360 Brass (copper alloy with ≤ 4% Pb) is the standard alloy used for automatic screw machine products. There is no cost-effective substitute with comparable characteristics currently.

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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: N/A