



June 25, 2018

**Stakeholder Consultation Questionnaire: Exemption No. 8(j)**

Antaya Technologies Corporation stakeholder submission for exemption review under Directive 2000/53/EC

Antaya Technologies has an extensive history of demonstrating our commitment to developing technically viable substitutes for toxic materials in vehicles wherever possible. Our efforts extend throughout our supply chain with significant focus on eliminating toxic substances in the manufacturing processes in our plants and in our customer's plants. For over twenty years Antaya has been working in strategic partnerships with interested parties to develop and validate lead-free solder alternatives that are not only technically viable, but true drop-in replacements for leaded solders. Our production scale processes have been in place since 1998 and continue to expand as the demand for lead-free solder increases. Today, Antaya produces over 20,000 pounds (9,100 kg) of lead-free solder annually for various applications and vehicle programs all over the world. We estimate that our efforts have removed 32,000 pounds (14,500 kg) of lead from the automotive supply chain, a number that will grow exponentially in the future as on-glass content in the vehicle increases. Antaya expects to continue our efforts to reduce health risks to our employees and our customer's employees, as well as mitigate the negative effects of our parts and processes on the environment.

Antaya Technologies again calls for the immediate removal of exemption 8(j) as we have viable solutions for removing lead in solders for any application, including laminated glazing. Our technology was a viable solution in 2013 when this exemption was previously reviewed. Since then, our lead-free technology has been developed even further and is only a stronger example of why we urge the European Commission to end exemption 8(j) immediately. Antaya is fully prepared to continue assisting our customers with the transition to lead-free solder for all applications. Our history indicates that we have been successful doing exactly that with multiple glass companies and automotive OEMs worldwide.

Antaya maintains our position that the use of lead in soldering for all laminated glazing applications, including in and on the glass, is avoidable. We applaud the European Commission for its commitment to reducing the severe health risks associated with the unnecessary use of lead in vehicles and look forward to furthering our commitment to this important activity.

Sincerely,

A handwritten signature in black ink, appearing to read "M. Jarod Scherer", with a long horizontal flourish extending to the right.

M. Jarod Scherer  
President  
Antaya Technologies Corporation

June 25, 2018

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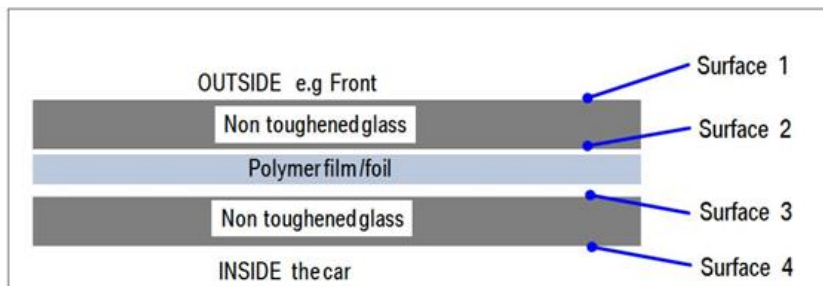
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Questions

1. *Please explain whether the use of lead in the application addressed under Exemption 8(j) of the ELV Directive is still unavoidable so that Art. 4(2)(b)(ii) of the ELV Directive would justify the continuation of the exemption. Please take into account the above described background information concerning the result of the last review as far as possible. Please be specific with your answer, for example clarify, if applicable, what types of vehicles your answer refers to, i.e., conventional vehicles and various types of hybrid and electric vehicles and which functionalities the exemption still needs to cover.*

For the purpose of this submission, Antaya understands Exemption 8(j) to include soldering for all laminated glazing applications. Laminated glass consists of two non-toughened pieces of glass that are laminated together with a thin polymer layer. Soldering to laminated glass includes soldering “on” the glass (surfaces 1 and 4) and “in” the glass (surfaces 2 and 3).

Figure 33 shows a laminated glazing structure. Between two thinner panes of glass a polymer layer is embedded.



Source: ACEA Interpretation Guide for ELV Annex II

Although Antaya understands Exemption 8(j) as described above for the purpose of this submission, we still contend that the wording was altered by the European Commission in 2015. The wording of this exemption was changed from “Lead in solders for soldering *in* laminated glazing” to “Lead in solders for soldering *of* laminated glazing”. This updated wording changed the scope of the exemption from applying to surfaces 2 and 3 only, to applying to all surfaces. Not only was this updated wording unaligned with the consultant’s recommendation, but it was also inconsistent with what was agreed to by the European Commission in 2012.

Ultimately, Antaya maintains the position that the use of lead in the application addressed under this exemption is avoidable. Antaya has proven solutions for either interpretation and there are no functionalities the exemption still needs to cover. Antaya’s position is

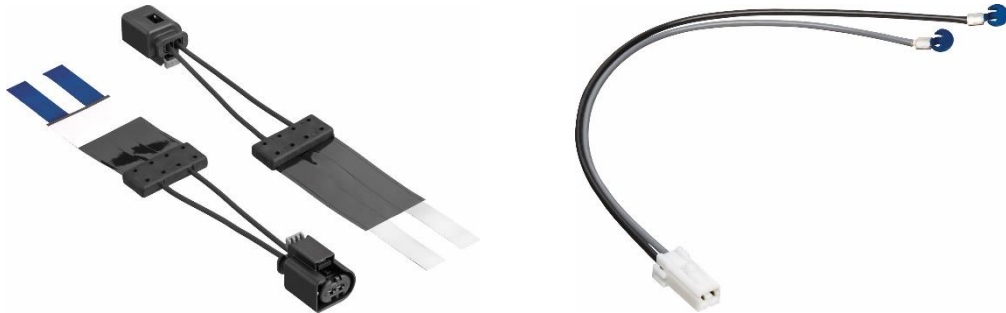
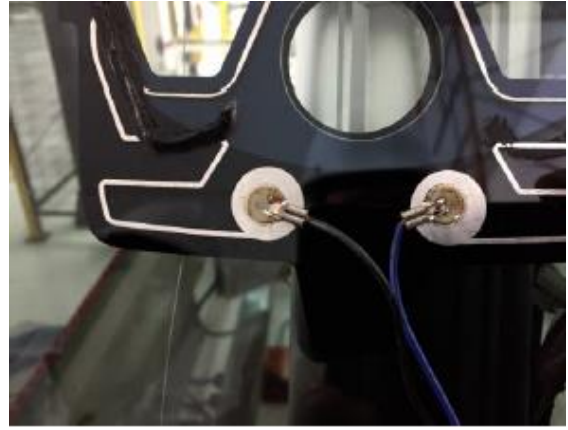
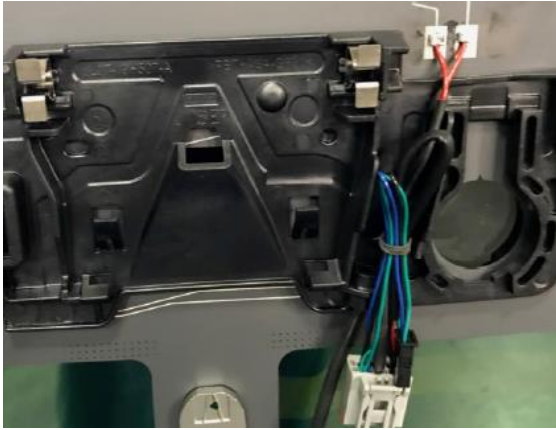
supported by Saint-Gobain Sekurit, a well-known leader in tier 1 glass, as evidenced in their stakeholder submission from October 2013. Both Saint-Gobain Sekurit and Antaya have publicly disclosed that we developed, tested, and are currently supplying lead-free solder alloys for laminated glazing applications for automotive glass. Specifically, Antaya's alloys have been fully industrialized and are in wide commercial use for all connector and vehicle types globally. This includes various glass companies such as AGC, NSG Pilkington, Fuyao, and Carlex and OEMs such as Ford, General Motors, Daimler, BMW, FCA, Volkswagen Group, and Tesla. Antaya's solutions for laminated glazing are feasible for all vehicle types including conventional, hybrid, and electric vehicles. From Antaya's perspective the vehicle type is not a significant variable when determining the on-glass connector and soldering process solution. Specific examples for each vehicle type are detailed in Question 2.

Further, Antaya offers drop in solutions for programs transitioning from leaded solder to lead-free solder. The amended final report for the European Commission DG Environment under Framework Contract N° ENV.C.2/FRA/2011/0020 dated 01/07/2015 states that 1:1 drop in solutions must be available for all connector designs on the market. To this point, Antaya is able to manufacture any terminal with either leaded or lead-free solder and adjust soldering process parameters to accommodate the properties of the different alloy. With the combination of our lead-free solder alloys and soldering process expertise, we are able to provide 1:1 drop-in replacements for any terminal. These replacements offer at least the same performance as the leaded solution, and Antaya's lead-free solutions have certain performance benefits over leaded solders. In laminated glass applications, tier 1 glass companies see significant reductions in microcracks when using Antaya's lead-free solder in combination with our soldering equipment and in-plant support. Although there are many different variables when it comes to soldering to laminated glass, Antaya is ultimately successful creating stable and reliable soldering production processes. Antaya's engineers work closely with the glass companies to fine tune soldering parameters due to variables such as glass firing, silver content and porosity, black enamel print, and brushing to remove oxide. These are the same variables that must be understood and optimized in soldering processes using leaded solder.

In the same report referenced above, the principal applications of lead-based solder for laminated applications are highlighted. Antaya summarizes these applications below with select examples of programs currently utilizing our Indium-based lead free solder.

- Antenna
  - Daimler C292
- Heated wiper rest area
  - Ford C520 & P552
  - FCA KL
  - Tesla Model X & Model S
- Camera window
  - Ford V408, U553 & CD539
- Heated windshield
  - BMW F5X

Sample of production lead-free applications



2. *Please explain the efforts your organization has undertaken to find and implement the use of lead-free alternatives in the manufacture of laminated glazings for automotive uses. Please refer to alternatives, which at least reduce the amount of lead applied or eliminate its necessity altogether.*

Antaya began development for Indium-based lead-free alloys in the 1990's specifically to solve the cracking problem with leaded solder for laminated glass. We began manufacturing on-glass connectors with lead-free solder for these applications at production scale volumes in 1998. Below are examples of Antaya's first programs utilizing lead-free solder for laminated glazings.

- Ford Thunderbird
  - Conventional vehicle
  - Pre-soldered copper terminal with Indium based lead-free solder
  - In production from 2000-2005, no warranty claims related to the solder
  - Lead-free solder was specifically requested to solve cracking issues that were occurring with lead-based solder
- GM U Vans (North America – Chevrolet Venture, Oldsmobile Silhouette, Pontiac Trans Sport; Europe – Opel/Vauxhall Sinatra)
  - Conventional vehicles
  - Pre-soldered copper terminal with Indium based lead-free solder
  - In production 2000-2008, no warranty claims related to the solder
  - Released for volume production to fix cracking issues that were occurring with lead-based solder

Since the late 1990's and early 2000's, multiple OEMs have recognized the benefits of lead-free solder. Antaya has worked with many tier 1 glass companies to implement lead-free solutions for a wide array of applications. During this time period the choice to use lead-free solder was driven purely by performance. At a time when environmental regulations were not being considered, Antaya worked in various tier 1 and OEM partnerships to improve solderability and overall performance – and our lead-free solder was the key to these improvements. Below are some examples of more recent programs utilizing Antaya's lead-free solder for laminated applications.

- GM Chevrolet Volt (D1JCI)
  - Hybrid electric vehicle
  - Pre-soldered copper terminals with Indium based lead-free solder
  - In production 2010 – 2015
- Ford Escape (C520)
  - Conventional vehicle
  - Pre-soldered copper terminals for windshield heated wiper and camera window areas with Indium based lead-free solder
  - In production 2012 – present
- FCA Jeep Cherokee (KL)
  - Conventional vehicle
  - Pre-soldered copper terminals for windshield heated wiper area with Indium based lead-free solder
  - In production 2013 – present

- Tesla Model X & Model S
  - Electric vehicles
  - Pre-soldered copper terminals for windshield heated wiper and camera window areas with Indium based lead-free solder
  - In production 2015 – 2017

Not only has Antaya launched multiple programs with lead-free solder for laminated glass, but we also transitioned programs to lead-free that initially launched with leaded solder. An example of a program that Antaya successfully transitioned from leaded to lead-free solder is the Ford P552. These vehicles are produced in North America, where there is currently no legislation influencing this type of sourcing decision. This program, which is one of the largest programs in the world by production volume, transitioned to lead-free solder for laminated glass specifically for improved performance.

Today, Antaya's customers see the benefits of our continued development activity and experience in launching programs in high volume production with lead-free solder. We currently manufacture a range of alloys to meet various testing specifications and individual tier 1 and OEM applications and preferences. For Antaya, using lead-free solder does not limit the connector design. Any geometry or custom connection type made with leaded solder can also be made with lead-free solder.

Five years ago, Öko-Institut e.V. concluded that there was no evidence to support the unlimited continuation of Exemption 8(j) and recognized that both Antaya and Saint-Gobain Sekurit achieved lead-free solutions at that time. In the five years since the review in 2013, Antaya introduced two additional lead-free solder alloys that are already in use globally for laminated glazing applications. These alloys were developed to meet the higher temperature requirement set forth by the AK 2.1 draft standard for the European market. Below are regional examples of programs that are utilizing one of these newer alloys.

- Ford Edge (CD539) – Asia Pacific
  - Conventional vehicle
  - Pre-soldered copper terminals for windshield heated camera area with Indium lead-free solder
  - In production 2015 – present
- Ford Transit Connect (V408) – Europe
  - Conventional vehicle
  - Pre-soldered copper terminals for windshield camera heating with Indium lead-free solder
  - In production 2017 – present

- Tesla Model X & Model S – North America
  - Electric vehicles
  - Pre-soldered terminals for windshield heated wiper & camera areas with Indium lead-free solder
  - In production 2017 – present

Based on experience, Antaya strongly refutes the timeline presented by ACEA in *Figure 8-11: Timeline for Soldering of Laminated Glass Structures and Soldering on Non-toughened Glass* from the above-mentioned Öko-Institut e.V. report. This timeline contends that 48 – 60 months are “necessary for validation on vehicle level and ramp up of production processes.” Antaya maintains our stance that this timeline is significantly inflated and proves in multiple instances that lead-free solutions are already available for laminated applications. The timeline for launching a new program with lead-free solder is no different than launching a new program with leaded solder since lead-free solutions are already available.

Additionally, Antaya is awarded future business utilizing our lead-free alloys across all regions and with multiple tier 1 glass companies and OEMs. These programs have not started production and therefore specific details cannot be disclosed. As evidenced by previous review cycles, this activity is being driven by the impending expiration of Exemption 8(j) as technical solutions have been proven in mass production with every major tier 1 company. Without the enforcement of this expiration, this activity will be reversed in many instances when decisions are driven primarily by commercial motivations.

3. *Please provide a roadmap specifying the necessary steps/achievements in research and development including a time scale for the substitution or elimination of lead in this exemption.*

The roadmap for the necessary steps/achievements in research and development has already been executed. Therefore, the complete elimination of lead from solder for automotive laminated glazing applications is possible now. The launch of a program with lead-free solder can be executed in the same amount of time as a leaded program would be. Antaya is ready to support both new and existing programs including on-glass connection products with all required technical documentation, full PPAP, and soldering equipment and know-how including on-site support in the glass plants.

4. *What is the amount of lead that would be contained in laminated glazings of vehicles*
  - a. *Placed on the EU market and*
  - b. *Worldwide*

*in case the exemption remains valid beyond 2019? Please provide a substantiated estimate clarifying how you have arrived at the stated result.*

The race toward autonomous vehicles is driving an increase in the number of safety and convenience features on all types of vehicles, from conventional to electric. This has a

direct impact on the number of connections being made on laminated glass as features such as front mounted cameras and heated wiper rest areas become increasingly standard on many different types of vehicles. Antaya has been supporting customers and OEMs for a number of years as they add these types of features to laminated glass.

We have multiple examples of each application currently in production and use these examples as the basis for the following calculations. Antaya is using the applications listed in *Table 8-1: Calculation of Lead Use under Exemption 8(j) in the EU* from the Öko-Institut e.V. amended report dated 01/07/2015 as previously cited in this submission. Antaya estimates the average lead per vehicle figures based on data in the International Material Data System for actual parts that we produce. Additionally, the number of vehicles with application per year figures are updated according to; knowledge of market trends, intelligence Antaya has from recent quoting activity, and data from the “IHS Markit Light Vehicle Production Forecast: Base” report dated April 2018.

Table 1: Calculation of the annual lead use in the EU & Global

Application	Average lead per vehicle (g)	No of vehicles with application / year (EU)	Average EU total (kg)	No of vehicles with application / year (Global)	Average global total (kg)
Wired heated	0.5	2,000,000	1,000	9,300,000	4,650
Wire antenna	0.2	600,000	120	3,000,000	600
Wire heated wiper rest area	1.2	150,000	180	600,000	720
Printed heated wiper rest area	1.1	600,000	660	4,000,000	4,400
Printed heated backlites	0.9	600,000	540	3,200,000	2,880
Printed camera window	0.2	1,700,000	340	8,000,000	1,600
Printed antenna	0.3	600,000	180	3,200,000	960
		<i>Total [kg]</i>	<b>3,020</b>	<i>Total [kg]</i>	<b>15,810</b>
		<i>Total [metric tons]</i>	<b>3.0</b>	<i>Total [metric tons]</i>	<b>15.8</b>
Density Lead 11.36 g/cm <sup>3</sup>		<i>Volume [m3]</i>	<b>0.27</b>	<i>Volume [m3]</i>	<b>1.39</b>

Antaya estimates that with the removal of Exemption 8(j) about 3.0 metric tons of lead will be eliminated annually from the automotive glass supply chain in Europe. This number increases dramatically worldwide and amounts to about 15.8 metric tons lead being removed from the global supply chain on an annual basis.



The figures above were calculated by taking into account vehicle volumes from the IHS report cited above and average take rates as they are estimated today. If Exemption 8(j) expires at the end of 2019 as legislated, the automotive glass industry will continue to see the amount of lead removed from the supply chain grow at an exponential rate. Assuming relatively stable vehicle production volumes as forecasted in the IHS report referenced above and an increasing number of features on laminated glass as evidenced by market intelligence and recent quoting activity, Antaya estimates that between 38 and 42 metric tons of lead will be removed from the European supply chain over the next ten years. These figures represent unnecessary risk to the environment as well as to employees who come in contact with this substance at the tier 1 and the tier 2 levels.

5. *Overall, please let us know whether you agree with the necessity to continue the exemption and sum up your arguments for or against its continuation.*

Based on the evidence provided in the questions above, Antaya does not agree with the necessity to continue Exemption 8(j) beyond the scheduled expiration date. Antaya has been able to successfully demonstrate evidence for this argument from both a technical and a commercial availability perspective for all vehicle types and product applications. Antaya is not only able to meet current standards and requirements, but demonstrated the ability to adapt to ever evolving requirements over the past five years. We are confident not only in our current capabilities, products, and processes for soldering to laminated glazings but also in our future ability to support evolving customer and OEM requests. The points below summarize Antaya's argument for the removal of Exemption 8(j).

- Availability – Lead-free solder for laminated glazings is currently in use globally for all applications and is being supplied from multiple tier 2 companies, not just Antaya. Antaya is producing lead-free solder at production scale volumes and has been doing so for twenty years. The number of programs utilizing lead-free solder is increasing each year and Antaya's processes and capabilities are growing alongside the increasing demand. We are proactive in our approach to planning for the expiration of Exemption 8(j) and are well positioned to fully support customers with a range of available lead-free alloys.
- 1:1 drop in replacement – Antaya successfully converted multiple programs using leaded solder to lead-free solder, primarily for the benefits of improved performance. As mentioned in Question 2, the Ford P552 is a program that Antaya successfully transitioned to lead-free solder for this type of glass. Additionally, Antaya is able to manufacture any terminal with either lead or lead-free solder. What contributes to our ability to offer 1:1 drop in replacements is our soldering process equipment and expertise. Our On-glass Application Engineers make minor adjustments to the soldering process in the areas of timing and temperature to realize optimal results for soldering terminals with lead-free solder to laminated glazings.
- Type of vehicle – Antaya supplies lead-free parts for all types of vehicles, and in all regions, regardless of the propulsion method; conventional combustion engine, hybrid, or fully electric. In our experience, on-glass features related to laminated glazings are independent of vehicle type in regard to the technical feasibility of the solder.

- Type of application – Antaya supplies lead-free parts on a global scale for all types of laminated glazing applications. We have proven solutions for applications such as heated windshield, antenna, heated wiper rest area, heated backlight and camera window connections.
- Technical feasibility – Antaya’s lead-free solders conform to the requirements set forth by the USCAR 40 standard and the AK 2.1 draft standard. However, Antaya recognizes that there is no common standard among regions or OEMs and that leaded connectors are not subject to the same validation requirements as lead-free connectors. Antaya is consistently challenged with validating lead-free parts against standards that are not reflective of real world conditions. Despite these challenges, Antaya has also been able to successfully validate our lead-free solution to several individual OEM standards such as Audi PV1200, Daimler FuVo A 003 004 71 99, and Volkswagen “Schnell-Test”. Antaya believes that the standards will continue to evolve until an expiration date for Exemption 8(j) is firmly set.

With multiple lead-free on-glass connection solutions available, the laminated glass market is well positioned to continue transitioning from leaded solder to lead-free solder. Without the complete support of the European Commission the progress that was made to remove lead from the automotive glass supply chain will surely reverse. Antaya calls for complete alignment among all stakeholders with the common goal of eliminating this harmful and toxic substance according to the ELV Directive. As evidenced in this submission, significant scientific and technical progress have been achieved since the last review. This progress enables us to better support the transition to lead-free solder worldwide. For example, we expanded our resources to include local manufacturing in Europe. Additionally, Antaya has a team of global Engineers with specific resources dedicated to and operating actively in each region. As a result we now have wider networking capabilities and regional-based know how to support customers based on local market requirements. We are persistent in our efforts to invest in the future of automotive glass connections and are committed to the significant growth potential of lead-free laminated glazing applications. Based on the evidence provided in this submission, Antaya sees no justification for continuing Exemption 8(j).