# Exemption Request 18a: "Lead used in compliant pin connector systems for use in industrial monitoring and control instruments (only sub-category 9 industrial)", exemption to expire in 2024

1. You generally doubt the technical practicability and the long-term viability of lead-free pin connectors mainly because of the whiskers that were found to grow in the experiments you reference. As explained earlier, the fact that whiskers grow under certain conditions on lead-free pin connectors is not new scientific evidence.
Please explain in more detail how the information provided (or how additional information that you can provide) proves
	1. that whiskers actually will grow and that these whiskers actually will cause failures of your equipment in which you use the pin connectors during the lifetime of the equipment, and
	2. that there are no means to prevent this.
	3. Please also show that the current lead technology used in pin connectors reliably prevents failures due to the growth of whiskers.

Maybe you can use the list of products you present in your submissions in which these connectors are mainly used to make the above arguments more specific.

Granting an Exemption according to Art. 5 1(a) includes the criteria that “the reliability of substitutes is not ensured.” Empirical evidence of using compliant-pin connector systems containing lead within thousands of different products and applications over many years of active use has a demonstrated reliability that meets customer expectations and supports the brand-image of Category 9 producers.

Despite the availability of lead-free compliant pin connector solutions, questions on their long-term reliability continue to be raised across multiple product sectors[[1]](#footnote-1) and within Research organizations[[2]](#footnote-2).

Reliability of category 9 producer’s products extends to measurement performance: the consistency of accurate results over consecutive measurements over time. Please refer to the additional insights provided relating to Metrology and reliability in response to your General Questions (Q2) covering exemption requests 17a, 18a and 20a. Proving measurement reliability when substituting components has not been proven across the portfolio of Category 9 producers. While there is no argument that it is scientifically and technically practical to start the substitution, there are years of evaluation effort required to assure reliability in Category 9 products. Insight into the tasks and duration of these activities has been previously submitted ([[3]](#footnote-3) and below)



While evaluations and research continues to develop a deeper understanding of the reliability of these lead-free connector systems within Category 9 applications, *it cannot* be argued that the reliability is assured today.

1. The research has shown that Lead-free compliant pin connector systems exhibit tin-whiskers growth in environments where our products are used and in time periods vastly inferior to the life time of the equipment– this is established fact and cannot be disputed. We refer to the earlier submission that was made in this respect which answers a great part of the questions that have been set out by you in this section:



Asking us to prove that lead free compliant-pin connectors will cause failures is tantamount to asking us to prove that it would not; something which we could not assert with any certainty. Because the instruments are used for so long and the component part with the pin array is such a central part of the instrument it cannot be replaced (without replacing the whole instrument) nor can it be presumed to be harmless if whiskers grow over time. In fact logic suggests that tin whiskers would yield exactly the type of untraceable errors that would – at best - undermine customer confidence in the instrument or cause inexplicable accidents in another. Whiskers can cause connections that are (obviously) not designed to occur in the instrument – whether this is harmful or not cannot be said with certainty in every case. It is also practically certain that the problems will not occur in a homogenous manner nor under every circumstance. Heat, pressure and other usage condition could influence the extent to which a whisker causes a faulty contact. In short the growth of whiskers must be prevented or at least inhibited to the greatest possible extent to ensure long term reliability.

1. The means to successfully inhibit tin whisker growth is to add a small amount of lead – there are millions of man hours and decades of experience in the electronics industry that guarantee this. The use of nickel plated main boards by contrast – which is often touted as the solution to whiskers – has already been proved not be efficient enough for our purposes. There are some possibilities using conformant type coatings but these prevent servicing or repair of the equipment thereby undermining the long term usage of the instrument and later increasing the waste stream. The Toyota recall of vehicles was due a tin whisker issue that caused problems only in a handful (some say 3) of the millions of cars that were recalled. The fact that all of the cars had varying amounts of whiskering did not make a difference for Toyota’s decision to recall. The more recent issues with the Boeing Dreamliner and the insufficiently tested use of Lithium Ion batteries all indicate exactly the sort of concerns the T&M coalition is keen to avoid at any cost. Unfortunately we need the time to redesign, test, qualify and substitute to do so.
2. The current system (adding lead) has shown over decades of testing to prevent whisker growth. The coalition would be interested to learn of any study that makes claims to the contrary.
3. You explain the unique applications in your sector as follows:
	1. Instruments are portable and have to survive use and transportation over a typical life of 10 years;
	2. Products are specified to operate over a wide range of temperature and vibration environments (unlike ITE equipment);
	3. Multi-pin data interfaces operating with very high speed data rates;
	4. Compliant-pin connectors allow the maximum connectivity per unit area on a printed circuit board, meeting the needs of improved signal density and integrity;
	5. The long-term reliability of the compliant-pin connector to printed circuit board joint is a fundamental requirement: they are required to last the lifetime of the Instrument;
	6. Compliant-pin connectors are not reworked or replaced in Instruments due to reliability issues with the subsequent compliant-pin to PCB joint;
	7. It is not possible to solder alternative connectors reliably due to the pin density and subsequent heat-sinking thermal properties of the PCA.

Please elaborate, how these characteristics are related to your exemption request, i.e how the substitution of lead is technically impracticable, e.g. why the mobility of equipment requires the use of lead in the pin connectors.

Maybe you can use the list of products you present in your submissions in which these connectors are mainly used to make the above arguments more specific.

The issue is not one of absolute technical impracticality but of the need to assure the reliability of our products over the expected lifetime and use model:

The fact there are alternatives offered on the market is obvious – the problem with these is that their reliability is not assured for our products which, since the ROHS recast, is a recognized ground for granting an exemption. The mere existence of an alternative does not guarantee its functionality let alone allow one to assume it is reliable. So though we hesitate to claim there are no substitutes neither is it reasonable to claim the opposite namely that these substitutes will be functional in all cases.

From a Metrology perspective, Calibration is performed “*To establish the reliability of the instrument i.e. that it can be trusted*”[[4]](#footnote-4) Reliability in this context refers to the consistency of accurate results produced by test and measurement equipment over consecutive measurements over time. Please refer to the additional insights provided relating to Metrology and reliability in response to your General Questions (Q2) covering exemption requests 17a, 18a and 20a.Consequently, these submissions additionally support the T& M Coalition’s assertion that the “the reliability of substitutes is not ensured” in the context of the performance of Industrial Monitoring and Control Instruments”

The understanding of the need to assure the reliability, in all its facets, over the lifetime of our products seems to be at the core of the difficulty T&M Coalition members have to make their problems understood to non-industry experts. It cannot be underlined enough that qualification of our products is absolutely essential to guarantee their performs to all published specifications. Please also refer to the additional details we have provided regarding “standards” and the various qualification elements in answer to your General Questions (Q2) covering exemption requests 17a, 18a and 20a. Any doubt would prevent a manufacturer from marketing a product as the exactitude of the instrument is a key element of the reputation of the producer. One mistake could jeopardize the confidence in his whole product range and indeed can have catastrophic consequences due to the system critical applications that our instruments tend to be used for.

Products designed for bench top or field portable (installation test) use are subject to frequent shock and vibration incidents in their everyday use as well as when transported for Calibration[[5]](#footnote-5) to have their specifications verified. Even products designed to spend their operational life in production test racks have to be periodically removed from service and transported to a Calibration laboratory. The interval between calibrations is a function of the use model of the customer and their required measurement accuracy, and ranges from months to years. Such shock and vibration events introduce stresses which are known to promote tin-whisker growth.

In the case of portable instruments the situation is even more pronounced as they are frequently dropped from a small height to the floor. Even instruments of light weight will fall with >6-8G force onto solid ground if their weight is over a few kilo or so. This is a matter of simple physics and needs to be taken into account. Similarly transportable equipment or moveable equipment will frequently be shoved around on transport means as trucks and so forth whereby considerable impacts are incurred. Where in the case of a robust tool this is unlikely to cause issues – the sensitive nature of the instruments makes it a problem to assure that they will keep complying to specification over the longer term.

1. Long storage of components affects the life time and reliability of the components and of the assemblies that are produced with these components. Given the last time buys you claim to have made, please explain how you ensure the reliability of the pin connectors during the intended storage over many years.

Resorting to last time buys is in itself not unusual in any industry including high technology. The purchased parts will be stored in an environmentally sound and controlled manner. Usually this is in temperature and pressure controlled storage houses in packing that is sealed to include a desiccant. When the parts are taken into production years hence, they are warmed and reconditioned according to a rather routine process. This is done all the time in industry. Semiconductor manufacturers routinely create die banks for such purposes. The T&M industry manages huge banks of legacy parts precisely because there is a long term obligation to service instruments after they have gone out of production. The norm for the industry is to provide full qualified service 5 years after an instrument is taken out of production – in many cases the actual service will be longer. This obliges us to maintain stocks of parts that would otherwise no longer be available and is a key part of the cost control required as a manufacturer – every additional part creates the need for storage and management for years and years. Such systems are laid down in industry best practice codes which are common to many companies.

1. Please provide a roadmap towards compliance including
	1. the various steps you need to go
	2. the related timelines

We believe that we have answered this in detail several times and yet it seems to be unrecognized so far. Please once again review and consider the information submitted to you in June 2012 inserted below that you have not published online as part of the public consultation



Based on this information, we can calculate that based on a reasonable assumption of best vs. worst case scenarios the timeline to carry through all the steps will average around 11 to 12 weeks or 3 months of FTE per product. We additionally refer to the detailed example given for Agilent in the submission of December 2012 (attached below and also not published on the consultation website) which provides an identical estimate and also explains the necessity to allow enough time to transition all products.



1. [Contribution from Continental AG](http://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_VIII/Request_18a/20130208_Continental_AG_Contribution_RoHS_exemption_request_18_a.pdf) [↑](#footnote-ref-1)
2. [TMC\_submission\_18\_a\_final](http://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_VIII/Request_18a/TMC_submission_18_a_final.pdf) Attestation from Michael Osterman, Ph.D. CALCE Operations Director <http://www.calce.umd.edu/> [↑](#footnote-ref-2)
3. [TMC\_submission\_17\_a\_-\_final](http://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_VIII/Request_17a/TMC_submission_17_a_-_final.pdf) [↑](#footnote-ref-3)
4. “[Metrology In Short](http://resource.npl.co.uk/international_office/metrologyinshort.pdf)” 3rd Edition, Page 17, Section 2.1.4 Calibration. [↑](#footnote-ref-4)
5. “[Metrology In Short](http://resource.npl.co.uk/international_office/metrologyinshort.pdf)” 3rd Edition, Page 17, Section 2.1.4 Calibration. [↑](#footnote-ref-5)