Lead-Free Customer Frequently Asked Questions (FAQ)

The following is a list of Frequently Asked Questions (FAQ) from customers on the elimination of lead from Molex products.

Why is Molex changing my product?

For more than 50 years, lead-bearing solders have been used almost exclusively throughout the electronics industry for attaching components to printed circuit boards (PCBs). However, such solders are now coming under close scrutiny due to concerns over lead ending up in landfills, and potentially contaminating ground water sources. Despite scientific evidence that indicates the environmental impact of lead from electronics is extremely low, if not immeasurable, a movement to ban lead from electronics has still emerged.

In October 2002, European legislation (the WEEE and RoHS directives) was approved banning lead from most electrical and electronic products starting 1 July 2006. Additional legislation (the ELV directive) targeting lead usage in the European Automotive industry went into effect July of 2003.

Although the legislation only directly covers the European community, anyone that supplies companies in Europe will also have to comply with the legislation. Molex is committed to supporting our customers in their transition to lead-free products by providing timely and effective solutions in line with their requirements. The transition to lead-free products within Molex began in 2000 and is expected to be complete in 2005, well in advance of the European legislation deadlines.

To help facilitate the successful implementation of these directives in the connector industry Molex, Tyco Electronics, FCI, and Amphenol have formed a collaborative working group whose mission has been to jointly provide common solutions to the industry's lead-free/RoHS related problems that will benefit both customers and connector industry suppliers. To that end, the collaborative group has developed common test standards and conversion strategies to help make the transition timely and efficient. In addition, Molex and the other connector manufacturers have jointly endorsed the choice of pure tin as the preferred lead-free finish for connectors. In a joint position paper, Molex, Tyco Electronics, FCI and Amphenol have collectively published the rationale behind the use of pure tin as the lead-free finish of choice for connectors.

To be able to allow our customers to certify that their end products qualify as lead-free Molex is in the process of eliminating lead from all our products.

MOLEX INCORPORATED
2222 WELLINGTON COURT, LISLE, IL 60532-1682
TEL 630-969-4550
FAX 630-969-1352 TLX 254069

What are the RoHS, WEEE, and ELV directives?

The primary driving force behind the movement to remove lead from electrical and electronic equipment can be traced to legislation originating in Europe. In late 2002 the European Parliament approved two directives related to the reduction of electrical and electronic waste. As part of that legislation, the use of lead in most electrical and electronic equipment will be banned or severely restricted. The Waste Electrical and Electronic Equipment (WEEE) and Restriction of Hazardous Substances (RoHS) directives call for the elimination of lead from most electronic equipment starting 1 July 2006.

In addition to these two directives, the EC has also passed a Directive on End-of-Life Vehicles (ELV), which targets lead used in automotive applications. Although lead in solders for automotive PCB-mounted components have a temporary exemption from the lead ban, certain uses of lead for connectors will not fall under the exemption and had to comply with the July 1st 2003 implementation date. Under the ELV directive lead-free is defined as a material containing no more than 1,000 ppm (parts per million) of intentionally introduced lead.

The Japanese consumer electronics manufacturers were amongst the first customers to start implementing lead-free programs. The Matsushita and Sony "Green Partner" programs were two of the first to require that all components supplied to them be free of all substances detailed in the RoHS directive.

In Japan, there is no legislation specifically banning the use of lead in electronics. However, there are two laws which, when combined, indicate that such a ban may be forthcoming. The first law, the Japanese Home Electronics Recycling Law, calls for OEMs to be prepared to collect and recycle four major products (TVs, refrigerators, washing machines and air conditioning units) by April 2001. The second law forbids these OEMs from putting any kind of waste leaching toxic elements into the environment.

Why can't Molex change to all new part numbers?

When these directives were passed the global connector manufacturers realized that this would be a huge issue for the entire electronics industry and specifically a major impact on the connector manufacturers and their customers. Molex is a full service broad line connector supplier with over 100,000 different products that are supplied to over 6,000 direct customers and countless more through our distribution partners globally from 57 manufacturing facilities in 26 different countries. To change all of the lead containing product part numbers is not possible because the scale of the task and the impact on our customers would be so large that it is not feasible to get all of the

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actions required accomplished in time to meet the customer deadlines for being lead-free.

To issue new end assembly part numbers engineering would have to change every Assembly Drawing, Sales Drawing, Customer Drawing, Catalog Drawing, and Website Drawing. The plants would have to change every Bill Of Material (BOM) master and every manufacturing routing in the Molex SAP Enterprise Resource Planning (ERP) and Materials Management (MRP) systems. All quality documentation for Inspection plans, Work Instructions, FMEA's, Control Plans, and PPAP's would have to be changed. All existing custom customer specific labels would have to be changed, and all assembly machine traceability and part marking programs would have to be changed to new part numbers.

If Molex changed to new part numbers it would mean that our customers would be forced to change all of the above mentioned documentation and systems within their own engineering and manufacturing organizations and fulfillment channels. Additionally customers would need to cancel and re-issue new POs under the new part numbers and change all of the Electronic Data Interchange (EDI) systems for the new part numbers.

Molex has gotten strong feedback from a large number of customers that they are unwilling and unable to resource all of the tasks necessary to roll out new part numbers. However, Molex customers who choose to may change their own internal part numbers for the Molex connectors they buy after the conversion to lead-free platings is complete on a part-by-part basis.

The lead elimination is a running change with no new part numbers or part number changes. There will be a transition period during which the plants will be shipping products containing both tin-lead and pure tin product. Not until the parts are entirely lead-free will they be labeled as lead-free.

Certain product families, primarily out of Japan, will be changing to new part numbers because they are converting to tin-bismuth platings from tin-lead for technical reasons discussed in following sections.

Why can't Molex just give the connectors I buy new part numbers?

Molex sells its products very broadly to over 6,000 direct customers, and to countless more customers through our distribution partners, all over the world, so it is not possible to only change part numbers for one customer without forcing the change on other customers. This is additionally complicated by the fact that all of our customers have different timelines for implementation of lead-free.

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Why can't Molex make both the tin-lead and pure tin platings available?

The Molex manufacturing plants do not physically have enough room to put both tin-lead and pure tin plating cells in line on all the reel-to-reel plating lines within Molex globally. Given the low levels of lead (less than 1000 ppm) permitted by the ELV directives it is not technically feasible to continuously change-over the plating chemistries from tin-lead to pure tin and back again while certifying that our connectors meet the sub 1000 ppm lead requirement.

Why can't Molex follow my Process Change Management (PCM) process?

We understand that many customers require longer than 60 days notice for changes and/or will want to approve the changes through their own Process Change Management system before Molex implements the change; however, this will not be possible. Due to the fact that every one of our over 6,000 customers has a different implementation date, it is not possible to carry both tin-lead and pure tin versions in parallel, that some customers want no part number changes and some that want all part numbers changed, there is no way that Molex can be compliant with our customers' individual Process Change Management requirements. Ultimately these systems have been put in place to reduce the risk to our customers and Molex feels strongly that eliminating the lead in our products as early as possible is the best thing that we can do to reduce the overall risk to our customers.

What testing data is available?

Solderability Performance
Separable Interface Reliability
Crimp Section Reliability
Whiskering
Solder Join Reliability (Tin, Tin-Lead, and Tin-Bismuth)

What risk is there to me as a result of the elimination of lead?

The predominant source of lead in connector products is in the terminal plating finish. Tin-lead is currently used for connector applications as a solderable surface, as a separable contact interface, and as a solderless interface (in press-fit, crimp, and wire wrap applications).

The solderability and contact performance of our selected pure tin plating is identical to that of the tin-lead plating. Molex has been producing the pure tin platings for both contact interfaces and solder tails for over 20 years and has no concerns about the elimination of the lead from the plating. Based on our experience and testing we expect

that customers will see no difference in the performance or processability of the pure tin product in their applications.

With pure tin as the lead-free finish of choice for a vast majority of all PCB mounted component suppliers (not just connectors), concerns about tin whisker formation have been raised. Tin whiskers are pure tin filaments that can grow spontaneously out of tin-rich coatings. There are concerns that in very fine pitch flex connectors; the whisker could be long enough to cause a short between adjacent conductors. The lead in tin-lead platings is effective in suppressing tin whisker formation and the concern is that removing the lead will lead to whisker failures. However, as mentioned earlier, Molex has been reliably using pure tin finishes on connectors for over 20 years without any instances of whiskers in the field.

Will I have whiskering problems?

Molex has been testing lead-free finishes for whiskering since 1999 and have found that both pure tin and tin-bismuth finishes with a nickel underplating layer minimize the propensity for whisker growth. This testing will continue as a means to further reduce the risk of whisker failures for our customers. The results of the study are summarized in a document entitled Tin Whisker Test Report. To provide consistency in the connector industry Molex, Tyco, FCI and Amphenol have developed a common tin whisker test standard that is used by each company to qualify lead-free finishes, which is available here.

Will the elimination of lead in Molex products increase my prices?

No, the elimination of lead alone from connector platings will not increase the price of Molex products.

Are my parts compatible with high temperature lead-free soldering processes?

There is a separate but related issue to the elimination of lead from PCB mounted components. As Molex customers eliminate lead from the processes in their manufacturing plants, they will be forced to utilize higher temperature reflow profiles which are required for lead-free solder pastes. The lead-free solder pastes require reflow temperatures in the range of 240-260°C, which can deform the thermoplastic materials used to mold many of the connector housings. We expect that this issue will become more pressing as customers start their internal lead elimination initiatives as the 2006 deadline approaches. Products which are capable of withstanding the higher reflow temperatures without deformation are referred to as "Lead-Free Process Compatible" or "High-temperature Reflow Process Compatible."

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Many materials are used for PCB mounted connector housings, but their ability to survive the lead-free soldering process can only be determined on a part-by-part basis with each customer's particular reflow process. A blanket qualification of plastic housing materials is not possible because a product's size, shape and configuration (e.g. wall thickness) greatly influence its ability to withstand the higher temperatures without blistering, deforming or discoloring. Each customer will be performing these evaluations as they each develop their own lead-free reflow process. In cases where a housing material change is required, the products will be tested according to a test standard that Molex, Tyco, FCI and Amphenol have developed and adopted for qualifying products to the higher lead-free reflow soldering temperature. A copy of the test specification can be found here.

Where applicable, Molex will release new product versions with different housing materials that are compatible with the higher reflow temperatures. These new product versions will have new part numbers.

How will I be able to provide traceability of lead vs lead-free product in my inventory?

Molex will be putting verbiage on the box label that details the product's status. The labeling descriptions are "Lead-free", "ELV: 2000/53/EC Compliant (v. 18/09/00)" and "RoHS: 2002/95/EC Compliant (v. 27/01/03)". Molex will additionally have product traceability information based on the date of manufacture for products. With either the label or the manufacturing date code, customers will be able to ascertain if the product in question contains lead. The reflow process compatibility temperature will not be marked on the box label but will be available on the product drawing.

The pure tin platings are compatible with tin-lead paste and wave reflow processes, so there will be no need to obsolete part numbers, scrap inventory, or return any product in inventory. RMAs (Returned Material Authorizations) will not be issued for products containing lead.

When will Molex implement the change from tin-lead to pure tin platings?

All connectors within Molex globally will be lead-free by December 2004 and are targeted to be RoHS compliant and Lead-free/High-temperature solder compatible by June 2005.

Molex is striving to minimize the risk to our customers by eliminating lead as far in advance of the deadlines as possible. The Automotive Division eliminated the lead in the products covered under the ELV directive in advance of the July 2003 deadline. The Americas Region Connector Products Division (CPD) will be the next to eliminate lead from its products. In the month of May, 2004 the CPD plants located in Little Rock,

AR and Lincoln, NE, will be eliminating all lead from all of the plating chemistries and plating lines and converting them to pure tin over nickel chemistries.

The goal of converting early is to give our customers the most amount of time to work the inventory in the supply chain down, so that there is minimal risk that there will be any lead containing product in the supply chain by the July 1, 2006 deadline. Lead containing product in inventory runs the risk of having to be scrapped by our customers after the deadline.

Each plating line in each entity within Molex globally produces many different product families and has a different conversion date. Customers will continue to be notified as each of the factories converts their lines to lead-free plating chemistries.

Many customers have not yet finalized their plans to implement lead-free processes and those that have plans show widely varying implementation dates. Molex is committed to providing a lead-free solution to meet our customers' requirements. While the legislation in Europe will drive the elimination of lead from products for many, others may require lead-free products significantly in advance of the July 2006 deadline.

What is Molex's lead-free strategy?

Molex's conversion strategy and associated material selection is based on customer feedback that the industry will use a mix of lead-free and lead-bearing products as lead is phased out of electrical and electronic products. During this transition, lot number, production dates, and labeling will be used to differentiate products containing lead from lead-free products. Molex will not change the part numbers when the lead is eliminated from the plating but will add new part numbers when the housing materials are changed to high-temperature compatible materials.

The first phase of the initiative is focused solely on the removal of lead from products, in this case the tin-lead plating. It purposely does not address the temperature compatibility of plastic housings. In this first phase, current tin-lead plated terminals will be converted to pure tin plated terminals. Because of the experience Molex has in using a pure tin finish and its compatibility with all reflow processes, there is no risk in switching to pure tin, as customers will see no change in performance.

High density FFC/FPC flex circuit connectors that are converted from tin-lead to tin-bismuth platings will be changed to new part numbers.

The second phase of the initiative involves changing the thermoplastic housing materials to ones that are compatible with the higher reflow soldering temperatures associated with lead-free reflow processes. For those products that require a change in the plastic housing material, new part numbers will be assigned. These parts are defined as lead-free or high-temperature reflow process compatible. Product from the first phase of the strategy is defined as lead-free.

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What terminal plating will Molex use for lead-free connectors?

In order to facilitate our customers' lead-free implementation, Molex has adopted a single, worldwide lead-free terminal finish pure tin over nickel for all but high density flex circuit applications. As a result of Japanese semiconductor industry requirements, Molex and the other global connector suppliers will adopt a tin-bismuth over nickel finish for high density FFC/FPC flex circuit connectors.

Molex and the rest of the connector industry have been reliably using pure tin as a finish on connector products for over twenty years. In addition, recent internal and external studies have validated the reliable performance of pure tin for connector applications.

Other connector manufacturers also endorse the choice of pure tin as the preferred finish for connectors. In a joint position paper, Molex, Tyco Electronics, FCI and Amphenol have collectively published the rationale behind the use of pure tin as the lead-free finish of choice for connectors.

The biggest question that has been raised regarding the use of bismuth containing finishes concerns their "backwards compatibility" for use in tin-lead soldering applications. This is due to the formation of a ternary alloy of tin, lead, and bismuth that melts at 96ºC. This ternary alloy could theoretically collect in the solder joint and cause decreased reliability in applications that approach or exceed its melting temperature. However, testing conducted by Molex has shown that the low level of bismuth used in the plating finish (2-4%) does not result in the reliability concern described above.

Will lead-free products be compatible with both my current tin-lead soldering process and the new high-temperature lead-free soldering processes?

Customers are converting to lead-free products at varying times, so it is important that lead-free products maintain compatibility with the traditional tin-lead soldering processes. Pure tin (the lead-free terminal finish of choice) has a history of reliable performance in tin-lead soldering processes and is also compatible with lead-free or high-temperature soldering processes.

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How will customers be notified of conversion to lead-free products?

Molex is sending out formal notification letters to customers notifying them of the changes as each of the factories convert to lead-free plating chemistries. These letters serve as the formal 60-day customer notification of a process change.

Is Molex involved in any industry consortia or focus groups related to the lead-free initiative?

To date Molex has been an active member of the Center for Advanced Vehicle Electronics (CAVE) consortia that has studied both component and printed circuit board (PCB) lead-free finishes. In addition, Molex participates in the activities of NEMI, Soldertec and JEITA working groups studying the tin whisker phenomenon.

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Where can I get more information on the Molex parts I use that are impacted by the plating conversion?

Any questions relative to the conversion dates or lead-free status of individual part numbers can be sent to the e-mail address leadfree@molex.com, if they are provided with a spreadsheet with the specific part numbers they can provide the detailed information by part number.

For a FAQ list covering more general lead-free topics please see the list compiled by the National Physical Laboratory (NPL) at www.npl.co.uk/ei/news/faqs.html.

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