Jack Crawford

Relearning Defects

Lead-free means changes in processing – and the way we assess failure mechanisms.

Even though my last standards update in July discussed standards for lead-free assemblies, we receive queries daily for information. So here's the good news: Balloting is underway to ratify IPC-A-610D and J-STD-001D.

We've reached this point through the dedication and perseverance of the committee members. Over the course of a week of meetings in August, the respective committees resolved over 350 comments and decided to circulate the documents to IPC membership for a vote. By the time you read this, the first ballot will be complete. These are complex documents, however, and it's possible (likely) that some members will vote negative – or against publishing – and provide additional comments. As I noted in January, that's how consensus-building works. The next meeting comes this month, with the goal to have these documents published by February.

Aside from some additions, clarifications and reformatting, there are relatively few changes from revision C criteria. This will ease the transition to revision D.

In reformatting IPC-A-610D, common topics are grouped; lead forming, placement and solder criteria are now in the same chapter. The through-hole chapter has separate sections for supported and unsupported holes so users do not have to sort requirements from a single table or clause. The solder chapter consolidates solder anomalies previously in multiple chapters. One chapter is specific to component damage. And finally, all PCB and assembly issues such as conformal coating, marking, cleaning and conductor/land damage are in a single chapter.

The committees that maintain IPC-HDBK-610 and IPC-HDBK-001 are already working on updated cross-reference tables and change summaries. They hope to release these support documents at the same time the standards are published.

An example of changed criteria: components with coating meniscus on the leads. The committee has resolved that the issue is not with meniscus in a hole. Rather, it's tied to whether the solder fillet meets minimum criteria. This was not obvious before and will be clearer in revision D.

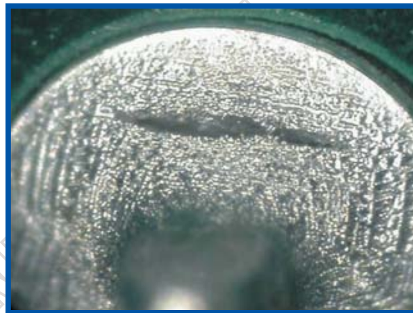

FIGURE 1: Example of hot tearing in PTH.

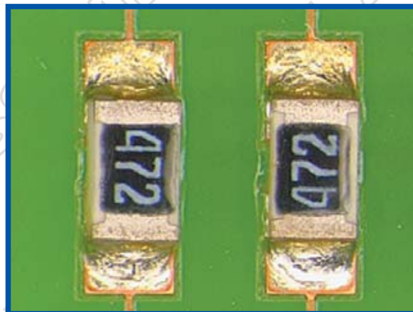

FIGURE 2: Example of cooling lines.

New content includes lead-free acceptance, of course, but also enhanced BGA criteria and clarification on BGA voiding. The committee has also added support for plastic no-lead packages such as PQFN, and components with bottom thermal plane terminations such as D-Paks. Much of the new lead-free information comes from large EMS companies including Jabil Circuit, Sanmina-SCI, Solectron and Flextronics, companies that are building lead-free assemblies.

IPC-A-610D and J-STD-001D won't resolve every inspection issue for lead-free assemblies. The industry will have a steep learning curve to understand that visual indications related to failure mechanisms in traditional tin-lead alloys are not necessarily representative of failure mechanisms in lead-free alloys.

For example, lead-free connections have a greater incidence of higher wetting angles and solder that has not flowed to the edges of lands. Hot tearing (**Figure 1**) and fillet lifting in plated-through-hole connections and cooling lines (**Figure 2**) also occur. No one has yet presented data that these are failure mechanisms.

To be notified when the documents are released, sign up at ipc.org/NewReleaseSignup. For updates and drafts, go to ipc.org/status. ■

Jack Crawford *is director of certification and assembly technology with IPC, Bannockburn, IL; (847) 615-7105; email: JackCrawford@ipc.org.*

FOR INDIVIDUAL USE ONLY – CIRCUITS ASSEMBLY PROHIBITS COMMERCIAL DUPLICATION AND DISTRIBUTION