

**iNEMI Statement of Work (SOW)
Environmentally Conscious Electronics TIG
iNEMI Lead-Free Rework Optimization Project**

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Purpose:

The purpose of the group is to evaluate and recommend best practices, rework equipment requirements, and procedures for best-of-breed lead-free rework processing in a manufacturing environment industry guideline.

Background and Motivation:

Reliability tests conducted by iNEMI's Lead-Free Assembly and Rework Project indicated a need for a follow-on project to investigate and improve the thermal fatigue life of certain components on the iNEMI Test Vehicle Payette board, such as the CBGA937, uBGA256, CSP81, which were reduced after rework.

Scope of Work:

The project proposes to address five aspects of the rework process:

1. **Rework tolerances and repeatability (Rework equipment manufacturers):** 1st priority
Full Machine Capability Analysis on rework production machine (MCA)
Accuracy, repeatability and reproducibility on machine (Gage R&R)
Use current standard documentation or procedure for this (ISO standard, etc)

Deliverable will be to determine process capability of rework equipment assessed.

2. **a) Optimized heat transfer into reworked boards (rework equipment manufacturers): use of heat shrouds, more uniform board heating:**
 - SMT BGA/CSP Rework Equipment suppliers
 - Hot Air Convection
 - Hot Air/ IR
 - Laser
 - Vapor Phase
 - Production available machines only to be assessed
 - Priority for existing production machine (out on market for at least a year)
 - Priority for Hot Air convection then laser then vapor phase

Deliverable will be to optimize heat transfer into lead-free reworked boards.

b) Work to reduce adjacent (top and bottom) component temperatures with development from rework equipment suppliers and process engineers from other companies on (CBGA/uBGA) board interactions on iNEMI Payette board:

- Board availability - Unused iNEMI Payette assemblies and profile boards with additional component availability needed (lead-free CBGA, uBGA)
- Other developments to consider: e.g. Coolcap
- Other tools to use: Thermal modeling of boards to replicate this issue: conduction versus convection into board and components
(Modeling will be board design dependent but will help in development of general design guidelines)

- Equipment suppliers:
 - Hot Air convection
 - Hot air/ IR
 - Laser
 - Vapor Phase
 - Production available machines only to be assessed
 - Priority for existing production machine (out on market for at least one year)
 - Priority for convection then laser then vapor phase
 - Other components: e.g. Coolcap
 - Thermal Modeling

Deliverable will be to reduce adjacent component temperatures during rework.

3. **BGA Socket rework (on 63mil, 93mil, 135mil thick boards).** This appeared to be an issue now (increased warpage of components during reflow and rework) for lead-free rework of 2006 RoHS legislation products.

The work in Section 3 (BGA socket) could be done once the optimized profiles and adjacent component project (Section 2 a and 2 b) were developed which would allow information from this part to be used in Section 3.

Deliverable will be to develop rework processes for lead-free BGA socket rework.

4. **Large I/O FCBGA area array package(plastic): 1mm pitch 45x45 mm package (1500-1900 I/O).** The previous project did not address this type of component. There may be warpage issues during rework for 93mil and thicker boards.

The work in Section 4 (FCBGA) could be done once the optimized profiles and adjacent component project (Section 2 a and 2 b) were developed which would allow information from this part to be used in Section 4.

Deliverable will be to develop rework processes for lead-free high I/O FCBGA.

5. **Lead-free mini-pot connector rework (63mil, 93mil,135mil boards).** The previous work covered on the iNEMI Payette board only worked on the DIP16. There were issues on holefill and copper knee dissolution. There would need to be an extension to other connector components. The iNEMI lead-free wave project group had indicated that they could make Phase 2 reliability test board available with connector components on the board to rework and potentially reliability test.

Deliverable will be to develop rework processes for lead-free connector components.

In addition, there will be some form of reliability testing and failure analysis involved as part of this work. Reliability testing may include ATC and bend testing. Failure analysis may include cross-sectioning, SEM/ EDX, CSAM, Moire.

Deliverable will be to evaluate the reliability of reworked lead-free FCBGA, BGA sockets, connectors and other BGA type components as well as assessing the reliability of adjacent components which have not been reworked.

Schedule:

It is envisioned that the project will be one year in length to coincide with the July 2006 ROHS deadline but the length will depend on the scope of work defined by the participants.

Resources Required from Participants:

iNEMI member companies will encourage the participation of individuals from different disciplines and divisions within their organization to contribute on the range of tasks outlined in the project plan. The group should contain members from or work closely with representatives of:

- OEMs
- Component and board manufacturers
- Assembly EMS providers
- Rework Equipment providers
- Solder Assembly material suppliers