IPC-7801

Reflow Oven Process Control Standard

Developed by the Reflow Oven Process Subcommittee (5-45) of IPC

Users of this publication are encouraged to participate in the development of future revisions.

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Reflow Oven Process Control Standard

1 GENERAL

1.1 Scope This standard provides process control for solder reflow ovens by baseline and periodic verifications of oven profiles using a standard methodology. Equipment calibration and maintenance guidelines are provided.

This standard is intended to verify the operating parameters of the reflow oven. This standard is not intended for the assembly product profile/recipe. ***For detailed information on development or verification of a product profile/recipe see IPC-7530.***

This standard does not provide guidance for vapor phase processes.

1.2 Purpose Intended for users of reflow equipment to baseline performance and periodically verify and demonstrate acceptable oven performance repeatability.

2 APPLICABLE DOCUMENTS

The following documents of the issue in effect on the invitation for bid form a part of this specification to the extent specified herein.

2.1 Joint Industry Standards[1]

J-STD-033 Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices

J-STD-075 Classification of Non-IC Electronic Components for Assembly Processes

2.2 IPC[2]

IPC-1601 Printed Board Storage and Handling Guidelines

IPC-7351 Generic Requirements for Surface Mount Design and Land Pattern Standard

IPC-7530 Guidelines for Temperature Profiling for Mass Soldering Processes (Reflow & Wave)

IPC-9194 Implementation of Statistical Process Control (SPC) Applied to Printed Board Assembly Manufacture Guideline

IPC-T-50 Terms and Definitions for Interconnecting and Packaging Electronic Circuits

2.3 ANSI[3]

ASTM/ANSI E230 Standard Specification and Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples

1. www.ipc.org
2. www.ipc.org
3. www.ansi.org

3 TERMS AND DEFINITIONS

Other than those terms listed below, the definitions of terms used in this standard are in accordance with IPC-T-50.

Convection Reflow Soldering – A solder reflow process where the primary means of heat transfer is by the recirculating flow of heated air or nitrogen in a Reflow Oven.

Delta T – Temperature variation across an assembly, specifically the difference between the highest and lowest temperatures on an assembly when measured at Peak Temperature in the profile across all the thermocouple locations (see Figure 3-1). A low Delta T is desirable.

Golden Board – A reusable test vehicle with thermal characteristics similar to a production assembly, used to measure Reflow Oven performance and repeatability. Sometimes called a ''witness board,'' ''standard test vehicle,'' ''thermal profiling board,'' or ''reference board.''

Liquidus – The temperature at which a solder alloy is completely melted. For more information, see the phase diagram of the solder alloy used.

Peak Temperature – The maximum temperature experienced at any point on an assembly during reflow soldering. The highest point on a Reflow Profile.

Preheat – A preliminary phase of the soldering process during which the product is heated at a predetermined rate from ambient temperature to a desired elevated temperature. Preheat reduces thermal shock and ensures uniform heating of the assembly up to Liquidus.

Profiling System – A data logger or measuring instrument for logging temperature and time data from thermocouples. Also ''Profiler.''

Ramp – A controlled and uniform increase or decrease in temperature, represented as a constant slope on the Reflow Profile. The magnitude of the slope is known as the Ramp Rate.

Recipe – A defined set of process parameters programmed into a Reflow Oven (see Figure 3-2). It includes a specific conveyor speed and temperatures within each Reflow Zone, and possibly the flow rates of air or nitrogen. The recipe typically varies with the thermal mass and other heat transfer characteristics of the assembly being soldered.

Reflow Oven – A solder reflow system, typically using mostly convection heating in an air or nitrogen environment. Conveyorized systems incorporate multiple reflow zones in series. Batch ovens offer lower throughput and are less common.

Reflow Profile – A graphical representation of temperature for a single or multiple locations on an assembly, plotted against time, during the reflow process. It may be a recommended ''baseline'' or Target Profile, or reflect actual measurements. Also known as ''Oven Profile.''

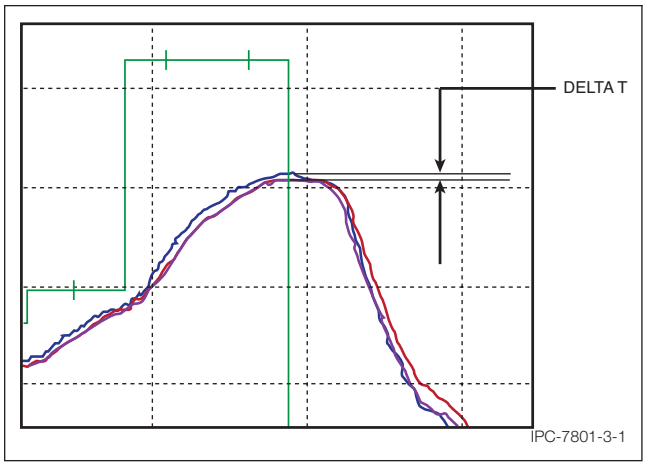

Figure 3-1 Identification of Temperature Delta at Peak Reflow Temperature

Delta T = Difference between highest measured temperature and lowest measured temperature.

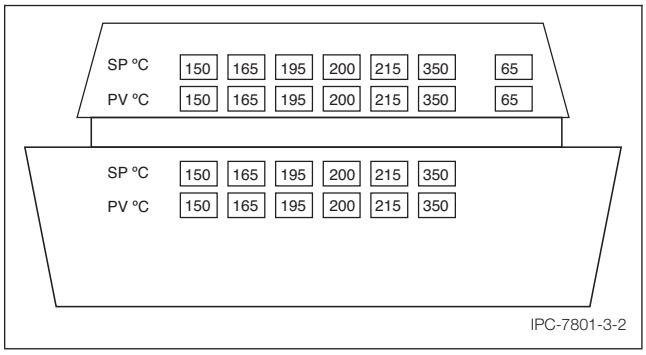

Figure 3-2 Example of Reflow Oven Recipe Set Points

SP = Set Point

PV = Present Value (Measured Value)

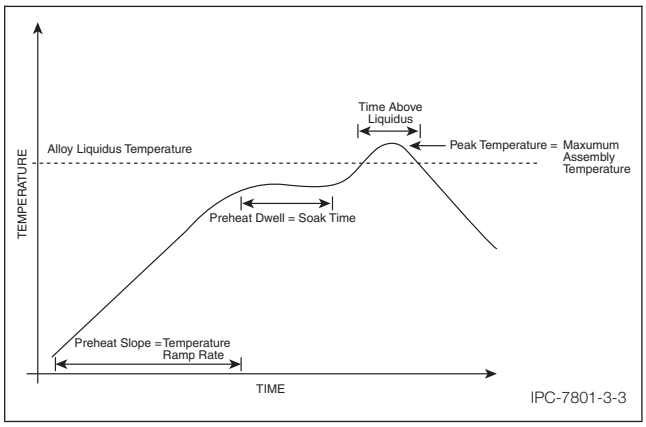

Figure 3-3 Zones in a Typical Reflow Profile

Figure 3-3 shows a typical oven profile which is primarily characterized by one temperature-time graph.