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IPC-4556A

Specification for Electroless Nickel/ Electroless Palladium Immersion Gold (ENEPIG) Plating for Printed Boards

Developed by the 4-14F ENEPIG Task Group of the Fabrication Processes General Committee 4-10 of IPC

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

Contact:

IPC

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1 SCOPE

This performance specification sets the requirements for the use of Electroless Nickel/Electroless Palladium/ Immersion Gold (ENEPIG) as a surface finish for printed boards. This performance specification defines ENEPIG deposit thicknesses for applications including soldering, wire bonding and as a contact finish. It is intended for use by chemical suppliers, printed board manufacturers, electronics manufacturing services (EMS) and original equipment manufacturers (OEM). This standard may be used to specify acceptance criteria to meet performance requirements in addition to those found in the IPC-6010 series (IPC-6012, IPC-6013 and IPC-6018) of standards. The ENEPIG deposit specified by using this document will meet the highest coating durability rating as specified in the J-STD-003 printed board solderability specification.

This specification is based on three critical factors:

1) The ENEPIG plating process is in control producing a normal distribution for nickel, palladium and gold deposit thickness.
2) That the tool used to measure deposit thickness, and therefore control the process, is accurate and reproducible for the thickness ranges specified.
3) That the ENEPIG plating process results in uniform deposit characteristics.

If any of these three critical factors are not met, then the deposit produced will not meet the performance criteria defined herein.

1.1 Objective This specification sets the requirements for ENEPIG as a surface finish (see Table 3-1 for a summary of these requirements). As additional surface finishes require specifications, they will be addressed by the IPC Plating Processes Subcommittee as part of the IPC-455X specification series. This and other surface finish specifications are under continuous review. The 4-14 subcommittee will make appropriate amendments or revisions to these documents as required. The 4-14 Plating Processes Subcommittee undertook ‘‘Round Robin’’ studies to generate data supporting the recommendations cited for the various aspects of this specification. For an outline of these, refer to Appendix B.

1.2 Description ENEPIG is a tertiary layered surface finish plated over copper as the basis metal. ENEPIG consists of an electroless nickel base layer over which an electroless palladium barrier layer is plated, followed by a thin deposit of gold as the final outer layer. For deposition process details, see Appendix A of this specification. It is a multi-functional surface finish, applicable to soldering and to gold, aluminum and copper wire bonding. It is also suitable as the mating surface for soft membrane and steel dome contacts. Additional applications include use in Low Insertion Force (LIF) and Zero Insertion Force (ZIF) edge connectors and for press-fit applications. The electroless palladium layer forms a diffusion barrier that impedes nickel diffusion to the gold surface. The immersion gold protects the palladium layer from reacting with contaminants prior to processing that might otherwise affect joining processes, such as wire bonding and soldering.

1.3 Classification IPC standards recognize that electrical and electronic assemblies are subject to classifications by intended end-item use. Three general end-product classes have been established to reflect differences in manufacturability, complexity, functional performance requirements, and verification (inspection/test) frequency. It should be recognized that there may be overlaps of equipment between classes.

CLASS 1 General Electronic Products Includes products suitable for applications where the major requirement is function of the completed assembly.

CLASS 2 Dedicated Service Electronic Products Includes products where continued performance and extended life is required, and for which uninterrupted service is desired but not critical. Typically, the end-use environment would not cause failures.

CLASS 3 High Performance/Harsh Environment Electronic Products Includes products where continued high performance or performance-on-demand is critical, equipment downtime cannot be tolerated, end-use environment may be uncommonly harsh, and the equipment must function when required, such as life support or other critical systems.

1.4 Measurement Units All dimensions and tolerances in this specification are expressed in hard SI (metric) units and bracketed soft imperial [inch] units. Users of this specification are expected to use metric dimensions. All dimensions > 1 mm [0.0394 in] will be expressed in millimeters and inches. All dimensions < 1 mm [0.0394 in] will be expressed in micrometers and microinches.