GENERAL STANDARD FOR COMPONENT FINISHES

1.0 SCOPE

This standard covers the general physical requirements and test methods for standard component finishes.

This standard, along with the individual component drawing, purchase order, and packaging specifications (supplied by Manufacturing and Purchasing), form the complete Finish Specification for Molex.

2.0 PURPOSE

The purpose of this standard is to provide a document that identifies the finishes, compositions, tolerances and performance requirements for component finishes used within Molex.

The established specifications in this document should be used whenever possible to minimize the variations.

3.0 REFERENCE DOCUMENTS

3.1 ASTM REFERENCE DOCUMENTS

- ASTM B281: Nickel Electrodeposited
- ASTM B487: Measurement of Coating Thickness by Microscopical Examination of a Cross Section
- ASTM B488: Electrodeposited coatings of Gold
- ASTM B545: Electrodeposited Coatings of Tin
- ASTM B555: Copper Electrodeposited
- ASTM B567: Measurement of Coating Thickness by the Beta Back Scatter Method
- ASTM B568: Measurement of Coating Thickness by X-Ray Spectrometry
- ASTM B579: Electrodeposited Coatings of Tin-Lead Alloy
- ASTM B679: Electrodeposited Coatings of Palladium for Engineering Use
- ASTM B700: Electrodeposited Coatings of Silver for Engineering Use

3.2 MILITARY REFERENCE DOCUMENTS

- MIL-C-14550: Copper Electrodeposited
- MIL-C-17711: Coatings, Chromate, for Zink Alloy Castings and Hot Dip Galvanized Surface
- MIL-G-45204: Gold Plating Electrodeposited
- MIL-P-81728: Plating, Tin-Lead Electrodeposited
- MIL-T-10727: Tin Plating; Electrodeposited or hot dipped, for ferrous and nonferrous metals

3.3 MOLEX REFERENCE DOCUMENTS

- SMES-152 Solderability Specification
- ES-40000-5012: Precious Metal Documentation and Weight Standard

3.4 FEDERAL SPECIFICATION REFERENCE DOCUMENTS

- QQ-N-290:Nickel Plating
- QQ-S-571:Solder, Tin Alloy, Tin-Lead Alloy and Lead Alloy
- QQ-T-371:Tin; Pig

3.5 ISO DOCUMENTS

- ISO-4521: Metallic Coatings-Electrodeposited Silver and Silver Alloy Coatings for Engineering Purposes
- ISO-4524: Electroplated Gold and Gold Alloy Coatings
- ISO-4527: Autocatalytic Nickel-Phosphorus Coatings-Specifications and Test Methods

4.0 DEFINITIONS

4.1 ALLOTROPIC

A property of certain chemical elements of existing in two or more distinct forms.

4.2 BARREL PLATING

An electroplating process that utilizes barrels as the transfer container for loose components from bath to bath to obtain the necessary cleaning and finish.

4.3 BRIGHTENER

An addition agent that leads to the formation or improves the brightness of the deposit.

4.4 CLAD

A fabrication process that involves roll bonding a thin noble metal inlay on top of the substrate material to form a composite. The clad material is located in the critical contact position.

4.5 CONTINUOUS (REEL TO REEL) PLATING

An electroplating process that utilizes the components themselves, bandoliers, or carrier strips to provide continuous piece part flow from bath to bath to obtain the necessary cleaning and finish. Usually the components are supplied on reels.

4.6 CONVERSION COATING

A coating produced by chemical or electrochemical treatment of a metallic surface that gives a superficial layer of a compound of the metal (e.g. chromate coatings on zinc and cadmium, oxide coatings on steel).

4.7 COVERAGE ZONE

Surface area that is normally visible or essential for serviceability or function of the component. Critical (Mating) is the area of the component that interfaces with another component and where the specific finish is mandatory. Non-critical (Transition) areas of the component that are non-functional that has sufficient thickness to ensure a uniform appearance.

4.8 DIFFERENTIAL SCANNING CALORIMETRY [DSC]

An evaluation technique that measures the heat flow into and out of a material. A typical DCS curve for a tin lead alloy will indicate two transition points at the eutectic temperature and the melt temperature of the material under investigation. The alloy composition can also be determined.

4.9 ELECTRODEPOSITED FINISH

A deposit applied by passing electric current through an electrolyte with subsequent adhering of ions to the base metal. Advantages of this technique are: consistent and uniform thickness over the plated surface, selective plating capabilities and relative low applied cost.

4.10 ELECTROLESS FINISH

A deposit applied by a controlled chemical reaction that is catalyzed by the component being finished.

4.11 FINISH CODE

Molex designation that defines the materials and thickness range requirements for a specific finish.

4.12 FINISH DEFECT: ADHESION

Adhesion failure is indicated when a plated deposit separates from the underlying base material either in the “as plated condition” or after a bend test. In the “as plated” state, any lifting or peeling of the finish is considered a failure. In the bend test, unacceptable finish layers(s) lift off the underlying layer at the edges. Acceptable finish layer(s) crack, but do not lift from the edges.

4.13 FINISH DEFECT: BLISTERS

A blister failure occurs when there is a localized failure of the finish to adhere to its underlying material. It appears as a spherical or raised area. A blister can be easily flattened or punctured with the tip of a razor blade while being examined with a low power microscope. The blister can be seen as hollow. Blisters are considered defects because any contact with the surface may break the bubble exposing the base layers to the atmosphere and potential corrosion.

4.14 FINISH DEFECT: BURNISHING

Burnishing occurs when abrasion has caused the finish surface to be worn down or polished. Most burnishing occurs in the assembly operation. If possible, nothing should come in contact with the mating contact before, during, or after plating. Burnishing should be avoided since it reduces the effective thickness of the finish layer.

4.15 FINISH DEFECT: BURNT DEPOSIT

A rough, or non-coherent or otherwise unsatisfactory deposit produced by the application of an excessive current density and usually containing oxides or other inclusions.

4.16 FINISH DEFECT: DEWETTING

A condition that results when molten solder coats a surface and then recedes, leaving irregularly shaped mounds of solder separated by areas covered with a thin solder film. Base metal is not exposed.

4.17 FINISH DEFECT: FOREIGN MATERIAL

Foreign material is any substance on the finish surface. Sources of foreign material include packaging materials, solder, slivers, (machine) oil or grease, airborne particles attracted by electrostatic charges, etc. Foreign material can impair product performance in two ways. First, organic type material could cause high contact resistance or open circuit contacts. Second, any material harder than the finish would cause excessive wear or gouging of the finish surface.

4.18 FINISH DEFECT: INDENTATIONS

An indentation is a surface recess or depression formed by imperfections in the immediate or underlying layers. Most indentations are the result of poorly prepared base material with nicks, scratches, and dents on the surface. Indentations can occur during some types of plating such as rack and selective strip plating. If these indentations cannot be eliminated, they should be minimized or processed such that the depressions are away from the critical contact area. Indentations are not necessarily detrimental, but may cause excessive wear.

4.19 FINISH DEFECT: NODULES

A nodule is a small irregular shaped mass of electrodeposited material and/or protruding base material that is raised above the surrounding surface area. Nodules are unacceptable since any contact may remove them. This will expose the underlying layers that are susceptible to atmospheric corrosion.

4.20 FINISH DEFECT: NONWETTING

A condition whereby a surface has been contacted by molten solder but the solder has not adhered to the entire surface. The base metal remains exposed.

4.21 FINISH DEFECT: POROSITY

Porosity is a defect of minute size, introduced during the plating operation that results in an opening extending to underlying layers. Porosity tests are usually performed in the critical (mating) area on precious metal finishes with pass-fail criteria based on the size and number of pores in a defined area. Porosity impairs product performance resulting in high contact resistance and open contact circuits after environmental exposure.

4.22 FINISH DEFECT: RAW EDGES

Raw edges are the edges of the base material near the critical contact area that are exposed to the environment as a result of a selective plating, preplating or cladding process. Raw edges are primarily the result of improved selective plating, or cladding techniques which the deposit or cladding is limited to a minimal critical contact area. Raw edges are also produced when preplated material is used to produce components. Corrosion products creep from the raw edges to the critical contact area resulting in high contact resistance and/or open circuits. The raw edges should be located where they do not interfere with the critical contact area, especially at the lead-in edge of the mating contact.

4.23 FINISH DEFECT: SCRATCHES

A scratch is a potential defect, depending upon its width and depth, caused by a scraping action over the surface of the plated or bare contact and characterized by sharp edges. Depending on the dept of the scratches, these defects may expose the base material to the atmosphere.

4.24 FINISH DEFECT: STAINS

Stains are discolored areas differing from the normal appearance of the finished surface. Stains, unless caused by contaminants, should not cause problems, but indicate a poor plating process, specifically in the rinsing and/or drying areas. This may result in poor solderability or short shelf life.

4.25 FLASH PLATING
An application of any overplated material 0.25 µm (~10 µinches) with a minimum thickness sufficient of 0.1µm (~4 µinches) to ensure complete coverage and uniform appearance.

4.26 "HARD" GOLD
An electrodeposit of gold "alloy" that has increased hardness due to the inclusion of cobalt or nickel to increase the materials wear resistance.

4.27 HOT DIPPED
A deposit applied by dip coat to a product in a molten solder bath. Some advantages of hot dip solder deposit are that the coating is soft, formable, free from porosity and will avoid whiskers forming.

4.28 HYDROGEN EMBRITTLEMENT
A deterioration of the tensile strength and ductility of the plated material caused by the plating and/or cleaning process. The inclusion of hydrogen will lower the ductility of the deposit and will affect the porosity of the deposit.

4.29 INLAY
A fabrication process that involves the cutting of a groove in the substrate material and then roll bonding a thin noble metal inlay to form a composite. The inlay material is located in the critical contact position.

4.30 INTERFACE DIFFUSION OF TIN
Diffusion of tin coatings and copper alloys is slow at room and rapid at higher humidity levels and elevated temperatures. Evidence of diffusion is the formation of a layer of copper-tin compound and zinc if the substrate is brass. Diffusion may lead to darkening of a tin coating and impairment of its solderability characteristics particularly after long storage. A nickel diffusion barrier, along with a thicker coating of tin, should be considered for longer period of solderability. An undercoat of nickel must be used as a diffusion barrier for brass. See Zinc Migration.

4.31 RACK PLATING
A process where the components are mounted in a rack or frame. This rack is transported through the process to obtain the required finish.

4.32 REFLOWED
Tin or Tin Alloy electroplating on either flat stock or stamped parts, which is heated to its melting point and then cooled. This results in a bright appearance with minimized surface oxidation. Possible benefits include tin whisker mitigation, improved solderability and cosmetic appearance at high temperatures, and a reduction in mating forces.

4.33 SELECTIVE PLATING
A deposit that is confined to a predetermined isolated area to provide the necessary finish required for functional performance at minimum cost.

4.34 SILVER MIGRATION
An electrochemical process that occurs between silver conductors separated by an insulator at voltage and high relative humidity and temperature.

4.35 "SOFT" GOLD
An electrodeposit of pure gold.

4.36 SOLDERABILITY
The ability of plated components to accept a new coating of solder to form a satisfactory fillet in actual use. Accelerated aging tests are employed to simulate natural aging under a combination of various storage conditions that have different deleterious effects to evaluate original plated surfaces.

4.37 STRIKE PLATING
An application of any underplated material between 0.1 µm (~4 µinches) and 0.25µm (~10 µinches) in thickness used to improve the adhesion. Strikes are used to improve the adhesion and reduce the porosity of the subsequent plating.

4.38 THICKNESS MEASUREMENT ZONE
Area specified on the component drawing where the specified plating thickness is required.

4.39 TIN TRANSFORMATION
Tin coatings, like pure metal, may be subject to allotropic transformation at low temperatures. The transformation is slow and its occurrence is relatively rare.

4.40 UNDERPLATE
A deposit of greater than 0.25 µm (~10 µinches) that will level the substrate or will serve as a barrier layer between the substrate and the final deposit, to provide some characteristics to the finished plated surface which the overplate would not otherwise exhibit.

4.41 VIBRATORY PLATING
An electroplating process that utilizes a vibration basket, to process products as loose piece parts.

4.42 WHISKERS
Metal filaments that grow spontaneously from the surface of electrodeposited metals, specifically tin. "Whiskers" are about 0.0001 inch (2.54 µm) in diameter and can grow up to 0.375 inch (9.56mm) long, and can carry a current of 10mA. "Whiskers" are particularly undesirable in low voltage applications where narrow spacing exists between adjacent components that must remain electrically isolated to avoid short circuits.

4.43 ZINC MIGRATION
The diffusion of zinc from the base material through a plated surface where it can react with the atmosphere to produce an insulating film.

5.0 FINISH PROPERTIES AND THICKNESS CODE DESIGNATIONS

5.1 COPPER DEPOSIT PROPERTIES

-Composition by weight
- 99.8% Copper Minimum
- Balance other metals and nonmetallics

[REF: NONE]
Density: 8.92 grams per cm^3
-Surface Appearance: Bright or semi-bright finish functioning as an underplate as noted on the Engineering Drawing

5.2 NICKEL ELECTROPLATED DEPOSIT

-Composition by weight
- 99.8% Nickel Minimum
- Balance other metals and nonmetallics

[REF: NONE]
Density: 8.91 grams per cm^3
-Surface Appearance
- Bright Finish functioning as an overplate
- Semi-bright or matte finish functioning as an underplate as noted on the Engineering Drawing

5.3 NICKEL-ELECTROLESS DEPOSIT

-Composition by weight
- 88-95% Nickel
- 5-12% Phosphorus
- 0.05% Maximum amount of other metals and nonmetallics

[REF: ISO 4527]
Density: 8.34 grams per cm^3
-Surface Appearance: Bright, semi-bright or matte as noted on the Engineering Drawing

5.4 TIN DEPOSIT

-Composition by weight
- 99.8% Tin minimum
- 0.1% Lead maximum
- Balance other metals and nonmetallics

[REF: MIL-STD-10727 AND ASTM B545]
Density: 7.35 grams per cm^3
-Surface Appearance: Bright, semi-bright or matte as noted on the Engineering Drawing

5.5 60/40 TIN LEAD ALLOY

-Composition by weight
- 60-70% Tin
- 1.0% Maximum other metals and nonmetallics
- Balance Lead

(continued……...)

[REF: MIL-STD-81728]
Density: 9.34 grams per cm^3
-Surface Appearance: Bright, semi-bright or matte as noted on the Engineering Drawing

5.6 70/30 TIN LEAD ALLOY

-Composition by weight
- 65%-75% Tin
- 1.0% Maximum amount of other metals and nonmetallics
- Balance Lead

[REF: NONE]
Density: 8.55 grams per cm^3
-Surface Appearance: Bright, semi-bright or matte as noted on the Engineering Drawing

5.7 90/10 TIN LEAD ALLOY

-Composition by weight
- 85-95% Tin
- 1.0% Maximum amount of other metals and nonmetallics
- Balance Lead

[REF: NONE]
Density: 8.34 grams per cm^3
-Surface Appearance: Bright, semi-bright or matte as noted on the Engineering Drawing

5.8 95/05 TIN LEAD ALLOY

-Composition by weight
- 93-97% Tin
- 1.0% Maximum amount of other metals and nonmetallics
- Balance Lead

[REF: NONE]
Density: 8.17 grams per cm^3
-Surface Appearance: Bright, semi-bright or matte as noted on the Engineering Drawing

5.9 SOFT GOLD DEPOSIT

-Composition by weight
- 99.9% Gold Minimum
- 0.05% Maximum amount of iron, nickel and cobalt combined
- 0.03% Maximum amount of iron, nickel and cobalt
- 0.04% Maximum amount of metallic impurities such as chromium, copper, tin lead, silver, cadmium or zinc

-Hardness [Knoop]: 90 Maximum
[REF: MIL-STD-45204]
Density: 19.32 grams per cm^3 [see 10.4]
-Surface Appearance: Bright

5.10 HARD GOLD

-Composition by weight
- 99.0% Gold Minimum
- 0.1% Minimum amount of iron, nickel and cobalt combined
- 0.1% Minimum amount of iron, nickel and cobalt
- 0.1% Maximum amount of metallic impurities such as chromium, copper, tin, lead, silver, cadmium or zinc
- Metallic hardening agents which are purposely added to the bath are not to be Considered impurities

-Hardness [Knoop]: 130-250 Maximum
[REF: MIL-STD-45204]
-Density: 17.50 grams per cm^3 [see 10.4]
-Surface Appearance: Bright

5.11 80/20 PALLADIUM NICKEL DEPOSIT

-Composition by weight
- 75-85% Palladium
- 0.02% Maximum amount of other metals and nonmetallics
- Balance Nickel

-Hardness [Knoop]: 480-530
[REF: NONE]
-Density: 11.40 grams per cm^3
-Surface Appearance: Semi-Bright

5.12 90/10 PALLADIUM NICKEL DEPOSIT

-Composition by weight
- 85-95% Palladium
- 0.02% Maximum amount of other metals and nonmetallics
- Balance Nickel

-Hardness [Knoop]: 300-350
[REF: NONE]
-Density: 11.71 grams per cm^3
-Surface Appearance: Semi-bright

5.13 PALLADIUM DEPOSIT

-Composition by weight
- 99.7% Palladium Minimum
- Balance other metals and nonmetallics

-Hardness [Knoop]: 75-400
[REF: ASTM B679]
-Density: 12.02 grams per cm^3
-Surface Appearance: Semi-bright

5.14 SILVER DEPOSIT

-Composition by weight
- 99.8% Silver Minimum
- Balance other metals and nonmetallics

-With supplementary chromate tarnish resistance treatment
[REF: ASTM B700]
-Density: 10.49 grams per cm^3
-Surface Appearance: Bright, semi-bright or matte as noted on the Engineering Drawing

5.15 MISCELLANEOUS DEPOSITS – WESTERN ELECTRIC #1 GOLD

-Composition by weight
- 69.0% Gold Minimum
- 25.0% Silver Nominal
- 6.0% Platinum Nominal
- 0.1% Maximum amount of other metals and nonmetallics

-Hardness [Knoop]: 130-200
[REF: NONE]
-Surface Appearance: Bright

6.0 FINISH THICKNESS TOLERANCES

Unless otherwise specified maximum finish thickness allowed above minimums:

FINISH	PROCESS	MAXIMUM FINISH ALLOWED ABOVE MINIMUM
Nickel	Continuous Plating	1.27µm (50 µinch)
	Batch Plating	2.54µm (100 µinch)
Copper	Continuous Plating	1.27µm (50 µinch)
	Batch Plating	2.54µm (100 µinch)
Tin	Continuous Plating	2.54µm (100 µinch)
	Batch Plating	6.35µm (250 µinch)
Tin-Lead Alloy	Continuous Plating	2.54µm (100 µinch)
	Batch Plating	6.35µm (250 µinch)
Gold	Continuous Plating	0.25µm (10 µinch)
	Batch Plating	0.51µm (20 µinch)
Palladium Nickel Alloy	Continuous Plating	0.51µm (20 µinch)
	Batch Plating	1.27µm (50 µinch)
Silver	Continuous Plating	0.51µm (20 µinch)
	Batch Plating	1.27µm (50 µinch)

6.0 FINISH THICKNESS TOLERANCES (CONTINUED….)

Process: Preplated, Reflowed and Hot Dipped		
FINISH	**MINIMUM THICKNESS SPECIFICATION**	**MAXIMUM FINISH ALLOWED ABOVE MINIMUM**
Tin	Minimum Thickness ≦ 2.50 µm (100 µinch)	2.54µm (100 µinch)
	Minimum Thickness >2.50 µm" (100 µinch)	3.81µm (150 µinch)
Tin-Lead Alloy	Minimum Thickness ≦ 2.50 µm (100 µinch)	2.54µm (100 µinch)
	Minimum Thickness >2.50 µm" (100 µinch)	3.81µm (150 µinch)

7.0 FINISH THICKNESS CODES

All finishes are to be considered post plated with the exception of platings designated as "Preplated", "Reflowed", and "Hot Dipped", e.g. Tin and Tin-Lead Alloy coatings. The following designations identify the OVERPLATE finish(es):

7.1 NICKEL
ES-88-A

7.2 TIN
ES-88-B

7.3 TIN-LEAD ALLOY
ES-88-C

7.4 GOLD
ES-88-D

7.5 SELECTIVE GOLD WITH SELECTIVE TIN
ES-88-E

7.6 SELECTIVE GOLD WITH SELECTIVE TIN-LEAD ALLOY
ES-88-F

7.7 GOLD OVER PALLADIUM NICKEL ALLOY
ES-88-G

7.8 SELECTIVE GOLD OVER SELECTIVE PALLADIUM NICKEL ALLOY WITH SELECTIVE TIN
ES-88-H

7.9 SELECTIVE GOLD OVER SELECTIVE PALLADIUM NICKEL ALLOY WITH SELECTIVE TIN- LEAD ALLOY
ES-88-J

7.10 SILVER
ES-88-K

7.11 MISCELLANEOUS
ES-88-L
A. Western Electric #1 Inlay Gold

7.12 CROSS REFERENCE GUIDE
ES-88-M

8.0 TIN AND TIN LEAD ALLOY APPEARANCE CODES

8.1 BRIGHT
When a bright finish is required, the prefix letter “B” is to precede finish code on the designated Engineering Drawing, e.g. ES-88-B201.

8.2 MATTE
When a matte finish is required, the prefix letter “M” is to precede the finish code on the designated Engineering Drawing, e.g. ES-88-M201.

8.3 SEMI-BRIGHT
When a semi-bright finish is required, the prefix letter “S” is to precede the finish code on the designated Engineering Drawing, e.g. ES-88-S201.

8.4 PRE-ELECTROPLATED (PREPLATED)
Preplated material will have a “P” designation. The designation should appear on the designated Engineering Drawing, e.g. ES-88-P201.

8.5 REFLOWED
Reflowed material will have an “R” designation. The designation should appear on the designated Engineering Drawing, e.g. ES-88-R201.

8.6 HOT DIPPED
Hot Dipped material will have an “H” designation. The designation should appear on the designated Engineering Drawing, e.g. ES-88-H201.

8.7 ELECTROLESS
Electroless finished material will have an “E” designation. The designation should appear on the Engineering Drawing, e.g. ES-88-E201.

8.8 UNPLATED AND RAW MATERIAL
All raw material and unplated parts will utilize a Finish Code of 999.

8.9 TUMBLED PARTS
All tumbled parts will utilize a Finish code of 990 with the specific process details identified on the Engineering Drawing.

9.0 PACKAGING AND SHIPPING REQUIREMENTS

9.1 SHIPPING INFORMATION
Detailed shipping information such as Finish Certification of Compliance, splicing method, winding directions, carton and reel specifications, pallet size, etc. shall be specified by Purchasing and Manufacturing.

9.2 PACKAGING/PROTECTION OF MATERIAL

All reels, interleaf paper, bags shall be sulfur-free and conform to the individual component packaging specification. The packaging materials used shall protect the finished components from corrosion or contamination during normal shipping and storage.

10.0 QUALITY ASSURANCE PROVISIONS

10.1 PLATING INFORMATION

The information to be included with each shipment of finished material should be the Engineering Number, Material Number, Lot Number, packaging list, and number of parts finished.

10.2 FINISH CERTIFICATION OF COMPLIANCE

A Finish Certification of Compliance should be attached to each lot of finished components. A test report will include the ES-88 finish alloy description, thickness and alloy composition specifications and tolerances. Samples shall be identified and submitted from each lot of finished material. Each lot of parts shall be tested for finish thickness, alloy composition, adhesion, solderability, porosity and visual appearance, as applicable.

10.3 LOT DEFINITION

In this specification, a LOT is defined as an individual set up of the production process for each material number. Multiple LOTS may not be packed on the same pallet.

10.4 BETA BACKSCATTER OR X-RAY FLUORESCENCE

Finish thickness and composition distribution shall be measured using either beta backscatter or X-ray fluorescence.

Many gold coatings have a density lower than the theoretical density of pure gold, 19.32 g/cm^3. The density of the gold coating depends on the type of gold coating, but can vary with the gold contents, the composition of purity of the electroplating solution. If the equipment used to measure thickness is calibrated with standards having a density of 19.32 g/cm^3, lower readings than actual will be obtained. To obtain a “linear” coating thickness, a correction factor, *f*, must be introduced. The readings must be multiplied by the correction factor:

$$f = \frac{19.32\ {}^{g}\!/\!_{cm^3}}{d}$$

Where “d” is equal to the density of the gold coating, g/cm^3.

The correction for Hard Gold shall be:

$$f = \frac{19.32\ {}^{g}\!/\!_{cm^3}}{17.50\ {}^{g}\!/\!_{cm^3}} = 1.1$$

10.5 CROSS SECTIONS

Cross-sectioned samples shall be used to resolve any differences due to potential measurement errors or uncertainty.

Cross sections shall be prepared with a layer of copper or nickel applied over the plated sample. This additional finish protects the finish under inspection from edge rounding and smearing during polishing.

10.6 BENDING OVER A MANDREL

Place the sample in a bend-testing machine with a bending radius of 4mm (or in the jaws of a suitable vise). Bend the sample through 90°. Examine the coating for signs of detachment under a 10x power magnification under an illuminated viewer. Cracking without separation does not indicate poor adhesion.

10.7 SCRAPING

After making a cut through the coating to the basis metal with a sharp instrument, and then probing the cut with a sharp point and examining at 10x power magnification under an illuminated viewer. No separation of the deposit from the substrate shall be evident.

10.8 TAPE

Apply the adhesive side of a non-transferable adhesive tape, with an adhesion value of 2.9 to 3.1 Newtons per centimeter (1.66 to 1.77 pounds per inch) of width (cellulose regenerated type), to the plating under test by finger pressure, taking care to exclude air bubbles. After an interval of 10 seconds, remove the tape rapidly by pulling in a direction perpendicular to the surface of the specimen. Check coatings for signs of removal under a 10x power magnification under an illuminated viewer. This test will only detect gross defects of adhesion.

10.9 SOLDERABILITY SPECIFICATION

SMES-152: Molex Solderability Specification

10.10 POROSITY

The test method (Molex, customer or industry) and pass-fail criteria (pore size and quantity per unit area) shall be documented on the Engineering drawing, as required.

10.11 INSPECTION CRITERIA

Current inspection criteria require visual examination of a component at 10x power magnification. Unless there is some special need to use magnification greater than 10x power, such as distinguishing between stains, blisters and porosity, all inspections should be carried out at 10x power.

In all cases, the critical contact area and plating thickness measurement locations shall be clearly defined on the Engineering Drawing. Defects outside the critical area should be noted but are not necessarily grounds for product rejection.